The Electrical Industry's Weekly Magazine

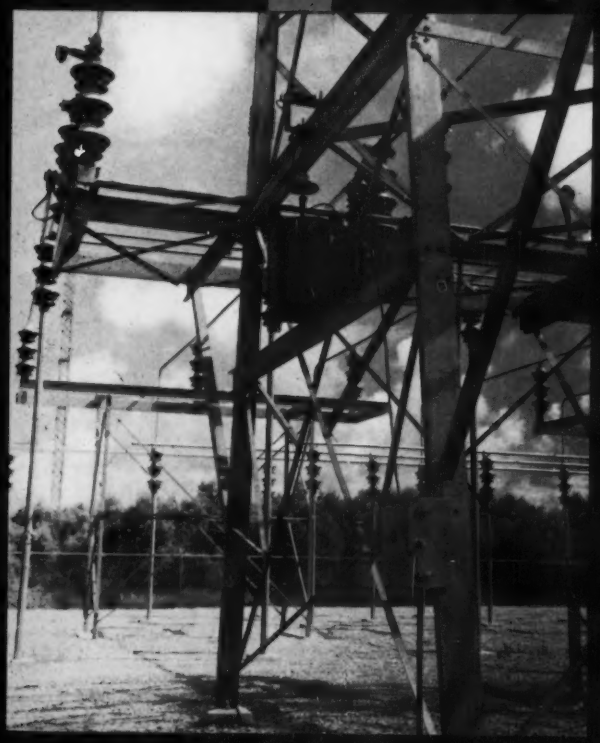
May 11, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Insulated Shield Wire Serves as Carrier Conductor...



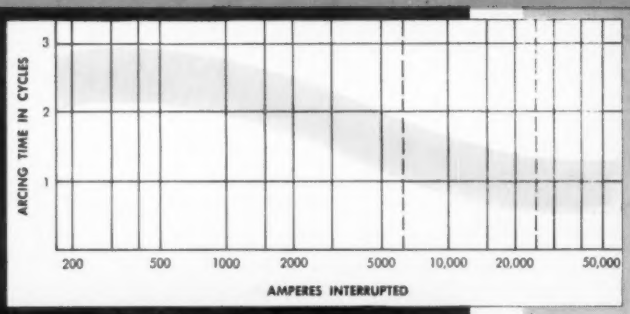
...page 42

Atoms for Youth Conference a Hit - p 36

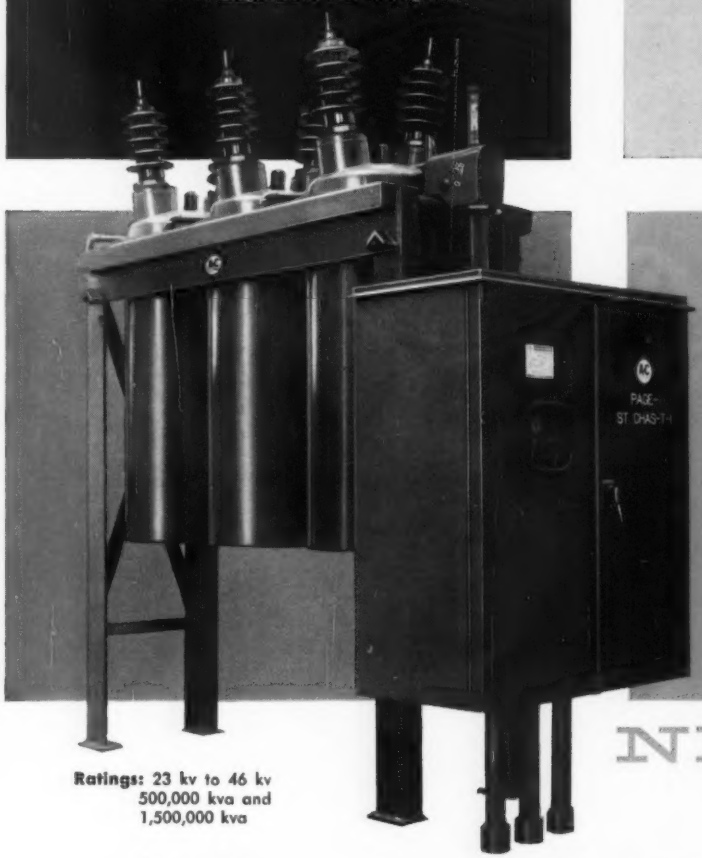
Congratulations to AI
On 75th Anniversary-p

STEVENS RICE GS W
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

ALLIS-CHALMERS modern line for '59



Graph shows short arcing times.



Ratings: 23 kv to 46 kv
500,000 kva and
1,500,000 kva

Low carbon production of new interrupter is illustrated by bottles. Samples taken at intervals from two units after same number of fault switching operations.

NEW interrupter cuts oil contamination

Reduced arcing time . . . less carbon . . . characterize new interrupting device for Allis-Chalmers frame-mounted breakers.

Contamination due to circuit interruption is greatly reduced . . . dielectric strength is extended.

Tests consisted of fault switching operations at current levels of 200 to 40,000 amperes.

Five-cycle operation

This new interrupting device with its matching high-speed *Pneu-Draulic* operator provides fast operation: closing, reclosing and interruption.

For complete details on Allis-Chalmers frame-type breakers, contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead—MODERNIZE!

Pneu-Draulic is an Allis-Chalmers trademark.

A-5916-E

ALLIS-CHALMERS

Electrical World

Vol. 151, No. 19 MAY 11, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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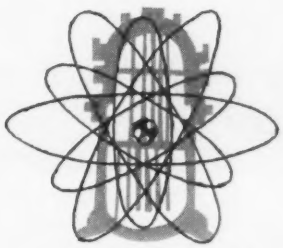

CURRENT EVENTS

Atoms for Youth Conference Rated a Hit

Youngsters, teachers, power company sponsors and U. S. news media enthusiastic about national get-together.....p 36

Volta River Plans Hold Promise for Ghana

Tiny West African state hopes to tap bauxite deposits with hydro and steam plants that Kaiser Engineers will build...p 38

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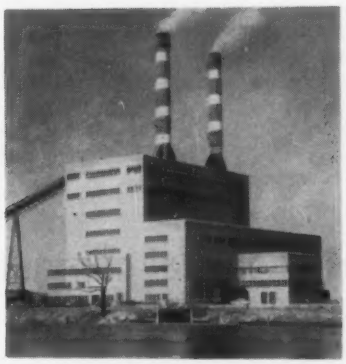

DISTRIBUTION

Load Study Shows Temperature Effects

R. E. Reinbold, Arizona Public Service Co

Data from actual in-service tests pinpoints usages, demands, and coincidence factors for predicting system effect.p 45

GENERATION

Pressure-Fired Cyclone Furnaces Perform Well

Leslie W. Hoffman, Wisconsin P&L Co

Experience report says 85% of fly ash goes out as slag, and stations requirements are only 6½% of gross output..p 48

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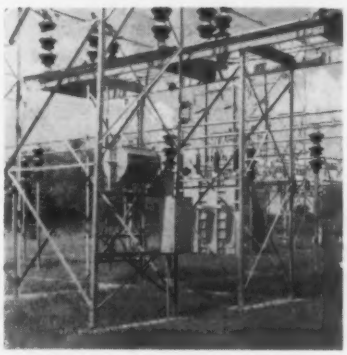

MANAGEMENT

Work Sampling Aids Management

Rogert V. Longdon, West Penn Power Co

New non-automated measurement tool answers problems of machine use, individual and crew performance.....p 47

RELAYING & PROTECTION

Carrier Operates on Insulated Shield Wire

Harold L. Deloney, Jack Davey, Louisiana P&L Co

Scheme is economical and versatile and has not adversely affected the lightning performance during past 3 years....p 42

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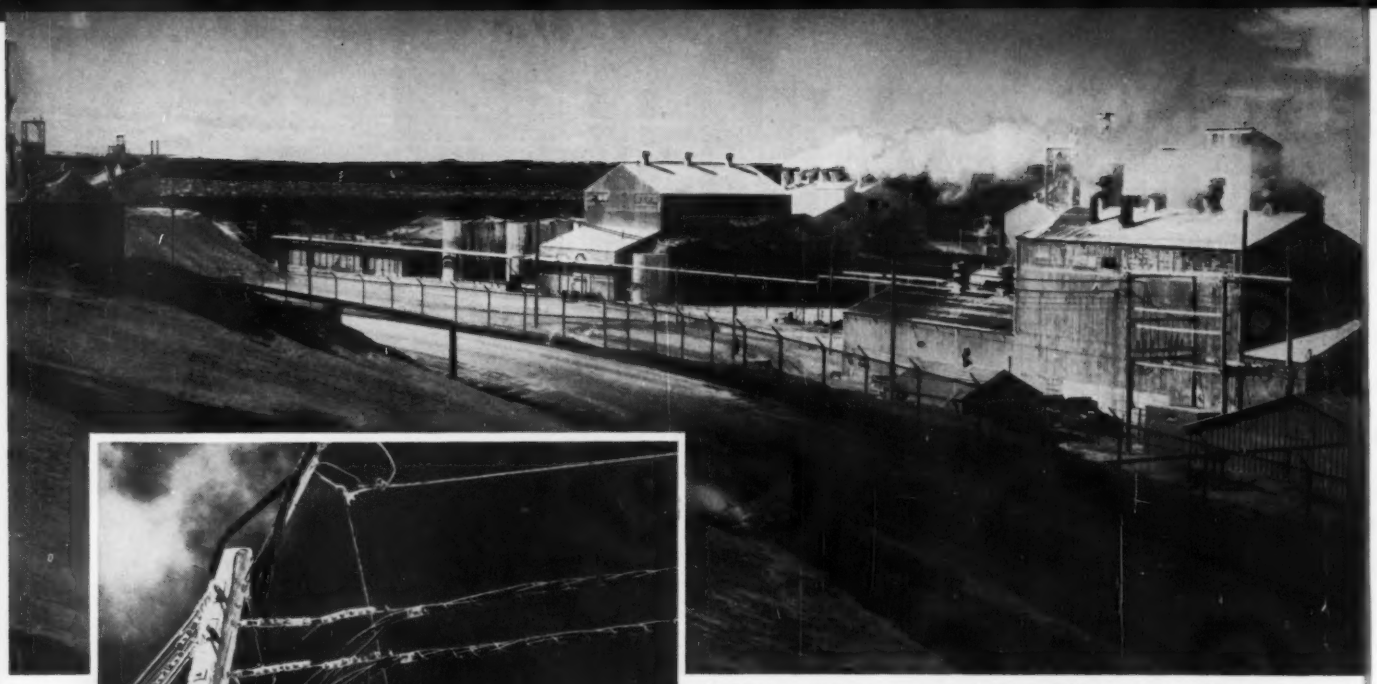

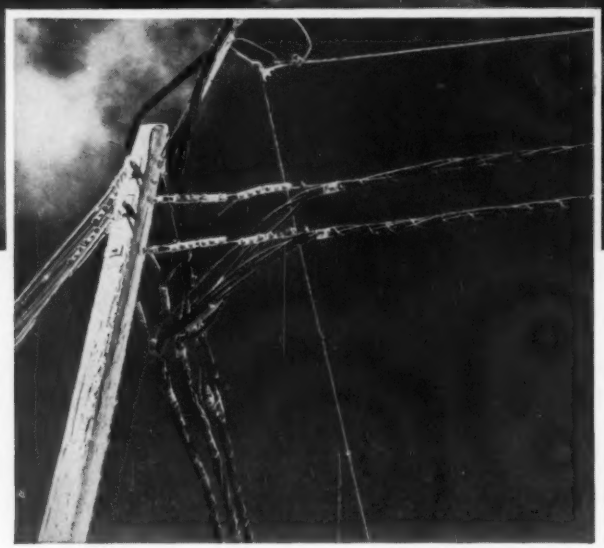

As the power goes . . . so go the operating costs at Intermountain Chemical Co.'s highly mechanized mining and refining operation. And every bit of this power—for digging, hoisting and processing of the ore—comes from Intermountain's power plant through 5kv non-shielded Okolite-Okoprene self-supporting aerial cables. They needed utmost dependability—and got it!

Heavy concentration of corrosive soda ash dust and severe environmental conditions have no effect at all on this aerial cable. Note the simple, low-cost support pole—no cross-arms needed—as well as the easy installation and splicing procedures used for this light weight, unshielded 5kv cable.

Okolite-Okoprene Aerial Cables withstand chemical contamination ...assure continuous production at Intermountain

"These 5,000-volt aerial cables have withstood heavy concentrations of soda ash dust for eight years now," says Louis Ruffini, staff assistant to the maintenance superintendent for Intermountain Chemical Company of Wyoming. "They've proved to be invulnerable to temperatures as low as —40°F and as high as 120°. They've faced winds up to 70 mph, and they tested perfectly at 40,000 volts d-c. We expect them to be around a long time yet."

These facts are vital to Intermountain. The company depends almost completely on electrical power to mine trona ore and refine it into almost half a million tons of soda ash per year. That's why they stress the dependability of their Okolite-Okoprene, 3/c, self-supporting power cables with aluminum conductors, cables that distribute power to every sub-station in the mine and processing plant.

"Installation of the aerial cables was very simple," says Mr. Ruffini, "thanks to their flexibility, light weight, and self-supported Dualay construction . . . and due also to the unshielded 5,000-volt construction that permitted the simplest of splicing and terminating procedures."

For *your* power needs, this construction can offer installation and operating economies, combined with long-term dependability. Okolite insulation has a 30-year record of service, maintaining in severest installation conditions its high dielectric strength and great resistance to corona cutting, moisture and heat. Okoprene sheath offers unusual protection against weather, abrasion, ozone, heat, cold, many acids, alkalies and chemicals. Application by the strip process of both insulation and sheath is the final assurance of matchless performance and long life. For the Okolite-Okoprene self-supporting aerial cable that best suits your needs, see 56-page Bulletin EW-1074. It's free . . . just write The Okonite Company, Passaic, N. J.

***where there's electrical power . . . there's* OKONITE CABLE**

6216

Where Are the Brain Stormers?

Somewhere along the line, Spring fever must have riddled the ranks of our Electrical Dreamers. After a flurry of letters following our previous call for the formation of an Electrical Dreamers Club, your correspondence has dropped off in this area.

We collected ideas for an electric chafing dish, new methods for home heating, and even an idea for an automatic parking device. We have even acquired a poet laureate in the person of Harold L. Sangster of Boyds, Maryland (EW, March 23, p 102).

If we don't watch out, the manufacturers will get ahead of the dreamers. One, for instance, has demonstrated an electric blanket that will either heat or cool the sleeper. And an electric eraser, for those who make mistakes, has recently come on the market.

So you see, we dreamers have some tough competition to deal with. If we're going to hold our own, we'd better come up with some ideas.

Meanwhile, we're still in the process of designing an appropriate membership card for those who send in their ideas for publication.

Fischer Black

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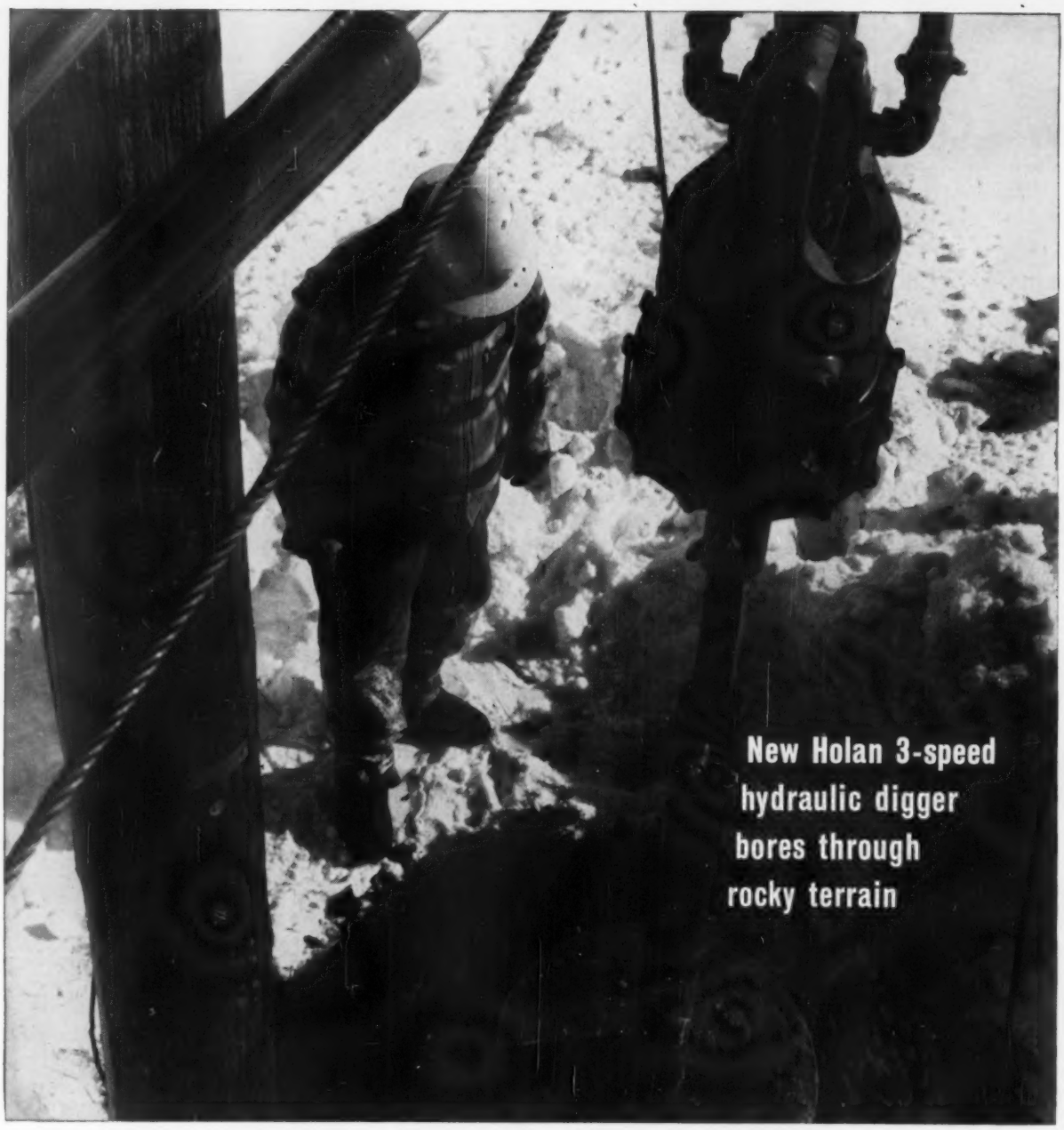

Torque: 8,400 ft.-lbs.

There's a new kind of hydraulic digger in the field—a digger with greater auger torque than any other derrick-suspended borer in use today.

The Holan 3-speed Series 5400 Digger handles augers up to 30 inches in diameter, and provides 8,400 ft.-lbs. torque. In addition to the high torque speed for big augers and tough digging, there's a faster speed for normal digging and augers 16 inches or less. A third speed is for spinning dirt and mud off the auger blades.

A positioning cylinder assures straight holes, aligns the auger for digging anchor holes and provides more clearance while setting poles. The swivel-mounted digger swings any way the operator desires. One man controls the unit from the rear of the truck.

To learn more about what the Series 5400 does—and how it works, call or write us.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

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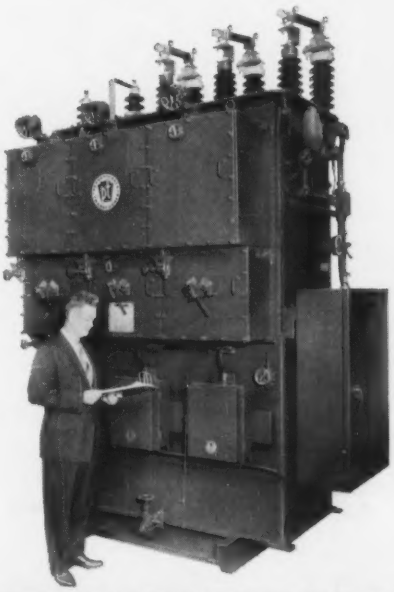
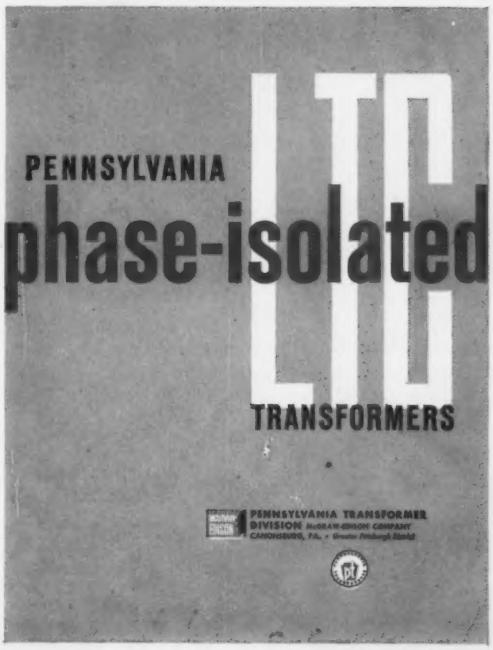
HOLAN

You'll want to know more about Pennsylvania's new

PHASE-ISOLATED LTC TRANSFORMER





FIRST *load tap changing transformer to permit safe maintenance of LTC contacts and drive mechanism without interrupting load*

FIRST *three-phase LTC transformer to provide individually controlled voltage regulation for each phase*

For the first time, here is a three-phase load tap changing transformer that offers *all* the advantages and flexibility of single-phase regulation. The cost is comparable to that of a conventional three-phase transformer and separate regulating equipment . . . and substantial savings result from the purchase, handling and installation of a *single piece piece of equipment* rather than three separate regulators, three separate bypass switches, and a transformer or bank of three transformers.

Pennsylvania's new Phase-Isolated LTC Transformer is completely self-contained. It includes an independent control circuit and LTC mechanism for each phase, thus permitting the outgoing voltage of each phase to be regulated in accordance with its individual load demands. Each phase also is equipped with a manually operated combination switch for bypassing, disconnecting and grounding. This permits safe inspection and maintenance of the LTC switch contacts and complete drive mechanism of any or all phases while the transformer continues to supply uninterrupted three-phase power.

Applications, voltage ratings, design details and other information are contained in Bulletin 591. For a free copy, mail the coupon below or write on your company letterhead to Sales Department, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

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J-M Transite Ducts permanently resist fire and arc... provide lifelong dependability, many operating economies

GONE ARE MANY of the headaches of transmitting heavy electrical loads underground, when you protect cables with Johns-Manville Transite® Ducts. They assure you of greatest protective value, and maximum load capacity, per dollar invested.

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Tests have shown that Transite-protected cables run cooler under given loads . . . carry greater loads at given temperatures because Transite helps dissipate heat faster. And for lower operating costs, consider the long-range value of Transite Ducts in terms of (1) increased insulation life, (2) fewer cable failures, and (3) lower I^2R losses for the full working life of a system.

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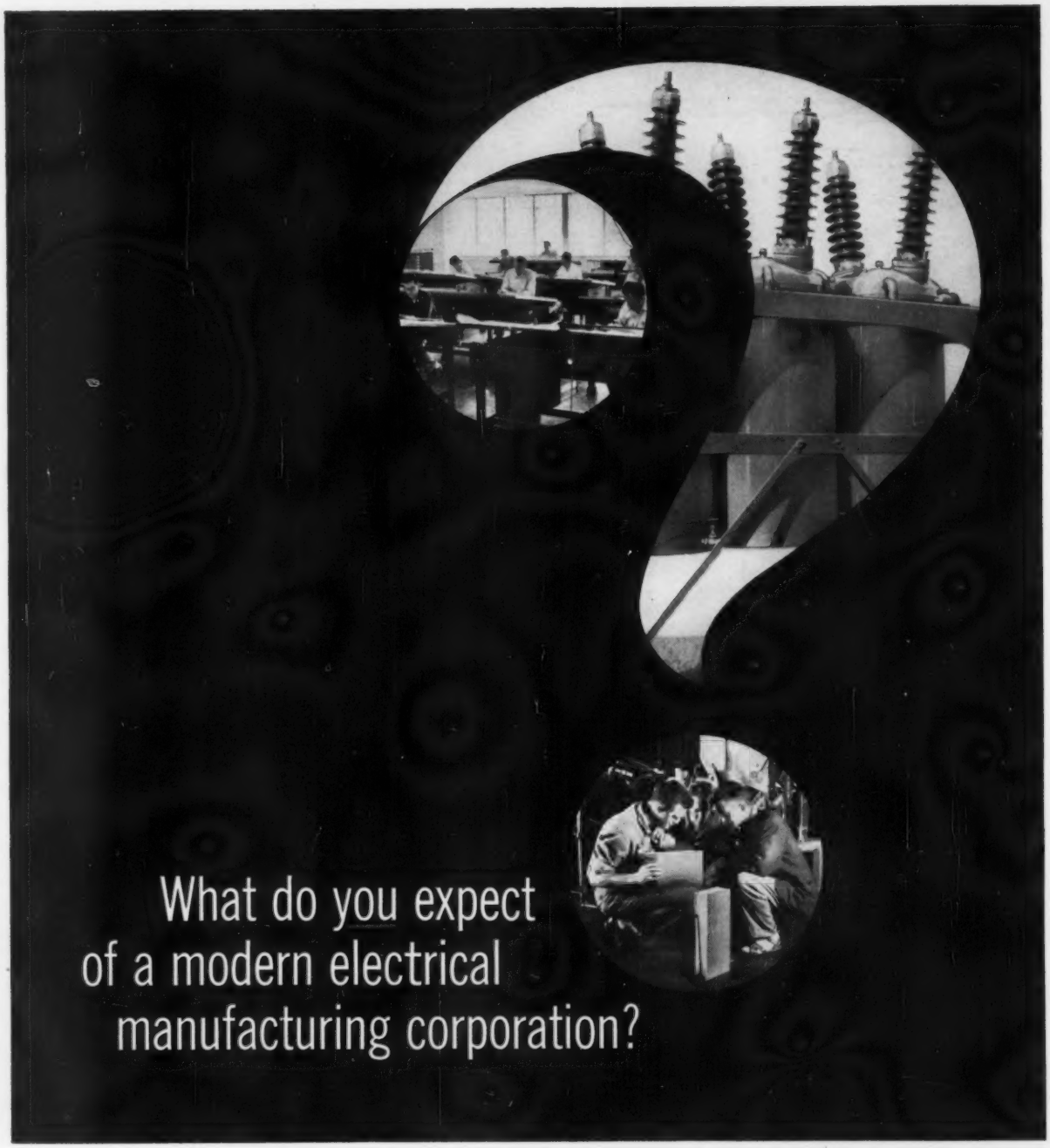

What do you expect of a modern electrical manufacturing corporation?

- ☐ A leading manufacturer in its field, professional in every phase of business conduct.
- ☐ Expansion at a rate faster than the remarkable growth pattern of the electrical industry.
- ☐ A forward-looking, soundly built organization working from this growth pattern.
- ☐ Each of its products a leader in its market.
- ☐ A company with integrity.

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FPE **FEDERAL PACIFIC ELECTRIC COMPANY**

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The Electrical Week

FUTURE NEWS ▶ **"Live Better Electrically" to sponsor 30-page ad section in LIFE** on Sept. 14. Editorial-style pages to make up a third of section, EEI advertising will account for seven pages, and manufacturers will take the rest, it was announced at New York press conference May 7.

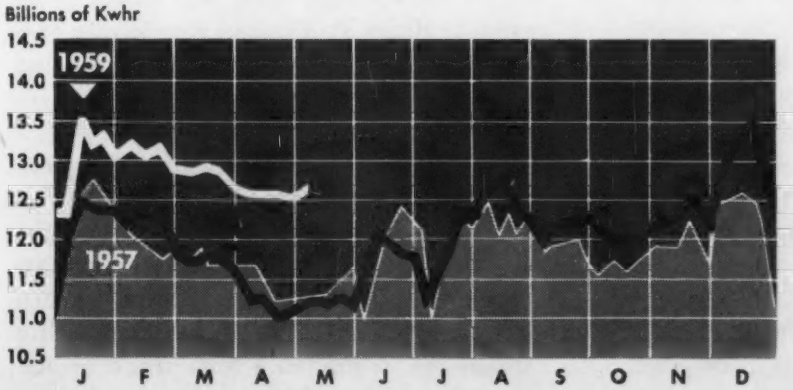
LATE NEWS ▶ **Manufacturers News** . . . GE announces first successful production of superheated steam in a U.S. A-power reactor. It was done with a special process tube inserted in an in-pile demonstration loop at Vallecitos BWR . . . Allis-Chalmers purchases ACF Industries' nuclear reactor office in Washington.

Labor Notes . . . Strike ends at Gulf Power as union workers vote 162-94 to return to work. Union demanded that it represent foreman and certain supervisors (EW, April 27, 1959, p44); company contended these employees are managerial. Case is now before U. S. District Court in Pensacola for ruling . . . Dallas P&L and IBEW agree on 5% wage increase.

Houston L&P asks City Council to approve rate hike of 50¢ minimum to 75¢ to eliminate demand-meter charge . . . Vp Frank Austin says HL&P will put rate in effect on its entire system if adopted by Houston . . . City of Portland asks Indiana PSC to raise minimum bill of 75¢ to $1 to eliminate inequities in service charges . . . Quote Ebasco's R. S. Quig last week before AGA financial symposium: "It is axiomatic that regulation must give weight to a utility's demonstration of a fair value rate base if the utility's rates are to be 'just and reasonable.'"

Management changes . . . Southwestern Electric Power elects R. W. Dodson and J. W. Sedberry vps . . Charles R. Bragg becomes executive director of the Electric Council of New England.

WEEKLY POWER OUTPUT—UP 11.5% (Week ending May 2), Kwhr 12,546,000,000



Per Cent Change From Previous Year

	April 18	April 25	May 2
Total U. S.	+13.5	+11.9	+11.5
New Eng.	+ 9.7	+ 7.3	+ 9.8
Mid. Atlantic	+11.7	+10.2	+10.0
Cent. Ind.	+17.1	+15.9	+16.0
West Cent.	+11.7	+10.7	+10.6
Southeast	+ 8.8	+ 7.5	+ 5.9
South Cent.	+14.3	+12.9	+13.5
Rocky Mount.	+12.9	+14.2	+15.7
Pacific			
NW	+11.8	+ 6.8	+12.6
SW	+23.8	+20.2	+13.1

Seasonally Adjusted Index 253.6

Week Ago 252.1 Year Ago 227.0

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Atoms for Youth Conference exceeds expectations,** say students, teachers, and sponsors who attended first national meeting. Local interest and enthusiasm was unprecedented, according to a number of 68 power companies represented **(p 36)** . . . Founders of AIEE will be commemorated May 13 **(p 38)** . . . IRS ruling states easement payments to property owners aren't taxable, if amount is less than cost of land **(p 39)** . . . PEPCO gets 7% rate hike **(p 40).**

ENGINEERING ▶ **Carrier operates on insulated shield wire of H-frame line.** This week's cover story about Louisiana P&L's experience with this interesting installation begins on **page 42** . . . Pressure-fired cyclone furnaces help Wisconsin P&L get 34.74% thermal efficiency at its Rock River Station **(p 48)** . . . An insight into the distribution problems you can expect with high heat-pump saturations is given by Arizona Public Service Co studies **(p 45)** . . . Work sampling measures job efficiency at West Penn Power Co **(p 55).**

PROCUREMENT & PRODUCTS ▶ **Residual oil prices are likely to remain easy** for the rest of the year despite import restrictions . . . Tendency toward hedge-buying of semi-fabricated aluminum is showing up . . . Industry will keep an eye on static relays . . . Small foreign cars for meter readers? **(p 56).**

Politics and Public Power

DEMOCRATS LEARN VETO IS KING

Failure of the House of Representatives to override President Eisenhower's veto of the REA (Humphrey-Price) points a moral:

The veto is king, and Congressional Democrats now know it.

Most Washington observers agree that when the Democrats were unable, in a clear-cut call for party regularity, to override the President on the REA bill, then there is little chance Eisenhower can be beaten when more substantive spending and power issues come to his desk for decision.

There are several measures in Congress which, if voted, face probable or possible presidential vetoes. And there are doubts supporters can make them veto-proof.

TVA Bond Financing. The President favors such legislation but with adequate controls over what the board can do. Supporters of the Democratic approach have tried to write a bill with limited controls. Now it appears they must give the President a bill he likes, or get no bill at all.

Trinity River Project. Here again, public power supporters have refused to consider an Administration recommendation that Pacific Gas & Electric Co build and operate the power facilities at Trinity. Supporters of a federal power project must face the fact that their plans apparently face a veto.

San Luis and other irrigation projects. These will have a rough road.

And there are still other implications; the ability of the GOP leadership to hold its ranks, even against political pressure by such as NRECA's General Manager Clyde Ellis.

Ellis had conducted a high-pressure cam-

MANUFACTURERS ▶ **Two companies reveal relays with no moving parts.** Allis-Chalmers has developed a static electronic overcurrent relay for power system protection; General Electric has new high-speed phase-comparison relay for high-voltage transmission lines **(p 58)** . . . Blaw-Knox builds minimum-height towers to lower aircraft landing hazards for details see **(p 60).**

NEW EQUIPMENT ▶ **Potential indicator for transmission lines up to 345 kv** is now available . . . Powered reel carrier loads, unloads and hauls reels up to 18,000 lb and 8 ft wide . . . Step regulators feature performance, maintenance, and safety improvements **(p 62).**

MANAGEMENT ▶ **How do utility common stocks look in the '59 market?** With industrial price/earnings ratios far above normal, and utility commons usurping the bond role in the conservative half of balanced portfolios, there's evidence that utilities offer the best offensive-defensive combination in today's uncertain market **(p 73).**

SELLING ▶ **"Housepower Box" helps boost appliance sales** by breaking inadequate wiring bottleneck. Details of Central P&L's wiring plan on **page 92.**

paign to make sure the bill was passed over the veto—he sent letters to all Congressmen and the day of the House vote, men wearing "save the farmer" badges toured the Capitol urging the bill be overridden.

MURRAY BILL—THE CAMEL'S NOSE

The adage about the camel's nose comes from the fact that he nudges it under the tent at night to keep it warm, then moves in his entire hulk, displacing the occupants. There's a "camel's nose" in Washington these days—Sen Murray's bill requiring the linking of hydro projects, public and private, in particular river basins.

Murray's proposal (S 1782) is in no way a package that Congress will vote on this year, or even next. But public power forces are joining to support the scheme, so it won't die. (The Liberal Public Affairs Institute has just released a report in which the Murray plan is endorsed along with a federal high dam at Hells Canyon, and a federal dam on the Potomac River near Washington.)

The Murray bill calls for coordinated operations in all cases where a gain in firm energy could "reasonably" be expected by such operations.

It would repeal section 10(f) of the Federal Power Act, which calls simply for the FPC to determine and assess "headwater benefit" charges between power dams operating on the same river. Murray would require FPC to assess these charges, but also require dam operators to adjust their power and water-release operations to provide maximum firm power output with the particular basin—inevitably cutting into the rights of individual dam owners to operate their dams to best fit into their own systems.

Executive Reader

Raising the mandatory retirement age to 68 for men and 65 for women allowed 37% of Consolidated Edison Co's employees affected by the option to work past the "normal" retirement age. Among the 207 who remained on the job during 1958 are engineers, technicians, business representatives, clerical workers, attendants, and guards. **Factory, April 1959.**

Designs and materials to extend blade life in coal-burning gas turbines will be studied through operation of a 4,200-hp unit at the Morgantown, W. Va., station of the Bureau of Mines. Initial phases of the program, sponsored by Bituminous Coal Research, Inc, solved three other problems connected with the direct-fired coal-burning gas turbine. **Bituminous Coal Research, Spring, 1959.**

Electric bills charged on credit cards is a service offered to customers of Hawaiian Electric Co. Patrons of a local charge club or a Hawaiian bank may have bills itemized with other charges covered by the one-credit-card service. **Electrical West Industry News Letter, April 15, 1959.**

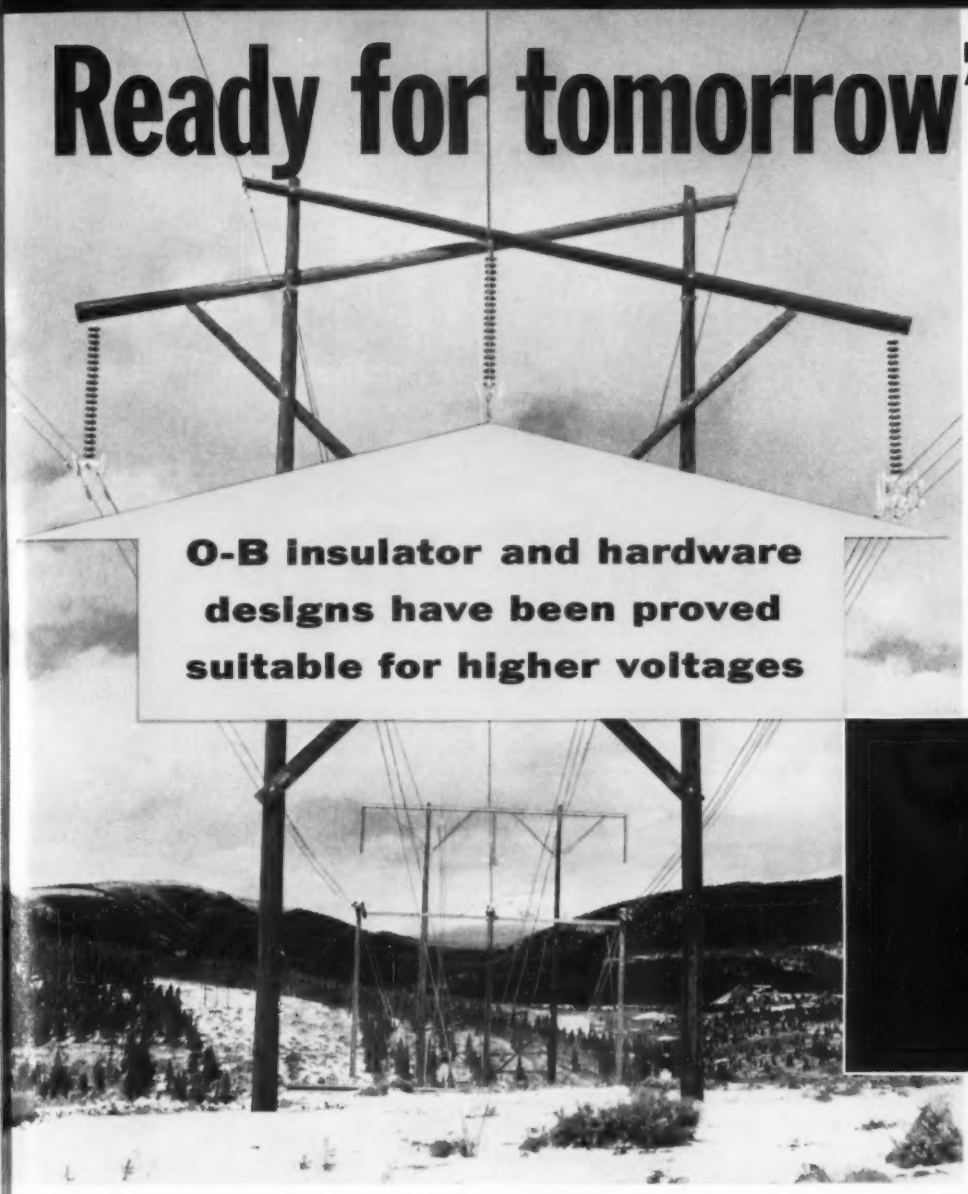
Use of lighting has doubled every decade for the last 50 years. This rate of growth continues today. This phenomenal rate could not have been sustained unless lighting responded to widespread human needs. **George E. Burens, General Electric Co, EEI Sales Conference, Chicago, March, 1959.**

NUCLEAR NOTES

Target of 15 million kw of nuclear power in Western Europe by 1967 is getting a second look by the Euratom Commission. A coal surplus in the six-nation European Community and an improving outlook in the free-world oil supply may shift emphasis to research into thermonuclear fission and away from construction of power-producing nuclear plants. Euratom still intends to continue the 1-million kw program under agreement with the United States, centering on experimental high-temperature, gas-cooled reactors. **Etienne Hirsch, President, Euratom Commission, Paris.**

Net power costs near 9 mills appear certain for present designs of large OMR (cooled and moderated by organic fluid) reactors. With more engineering experience, and within the near term, power from large OMR plants will compete with that from conventional stations. **W. E. Parkins, Atomic International, NICB Conference, Cleveland, April, 1959.**

Ready for tomorrow's EHV!



O-B insulator and hardware designs have been proved suitable for higher voltages

Suspension assembly for quadruple 1.40-inch bundle conductor test line, shown on test in O-B laboratory above, shown installed on test line at left.

400-kv? 550? 600? One, two, or four conductors? You make the choice as to what will serve your needs best when you plan an EHV line. You need not be limited in your thinking by hardware and insulator designs. Proved designs are already available. Some have served successfully for as many as seven years on 345-kv lines. Other designs to fit your specific requirements can readily be developed.

For higher voltages and multiple conductor bundles, optimum arrangements of insulators, clamps and shielding devices have already been proved in laboratory testing. It's significant that the clamps and insulators are of standard O-B design. The inexpensive shielding devices are modifications of designs now in service on 345-kv lines.

So as you make your EHV plans, keep this in mind. Laboratory facilities, design experience, manufacturing technique and the actual insulators and hardware designs themselves are available to meet the requirements of extra-high voltage transmission lines.

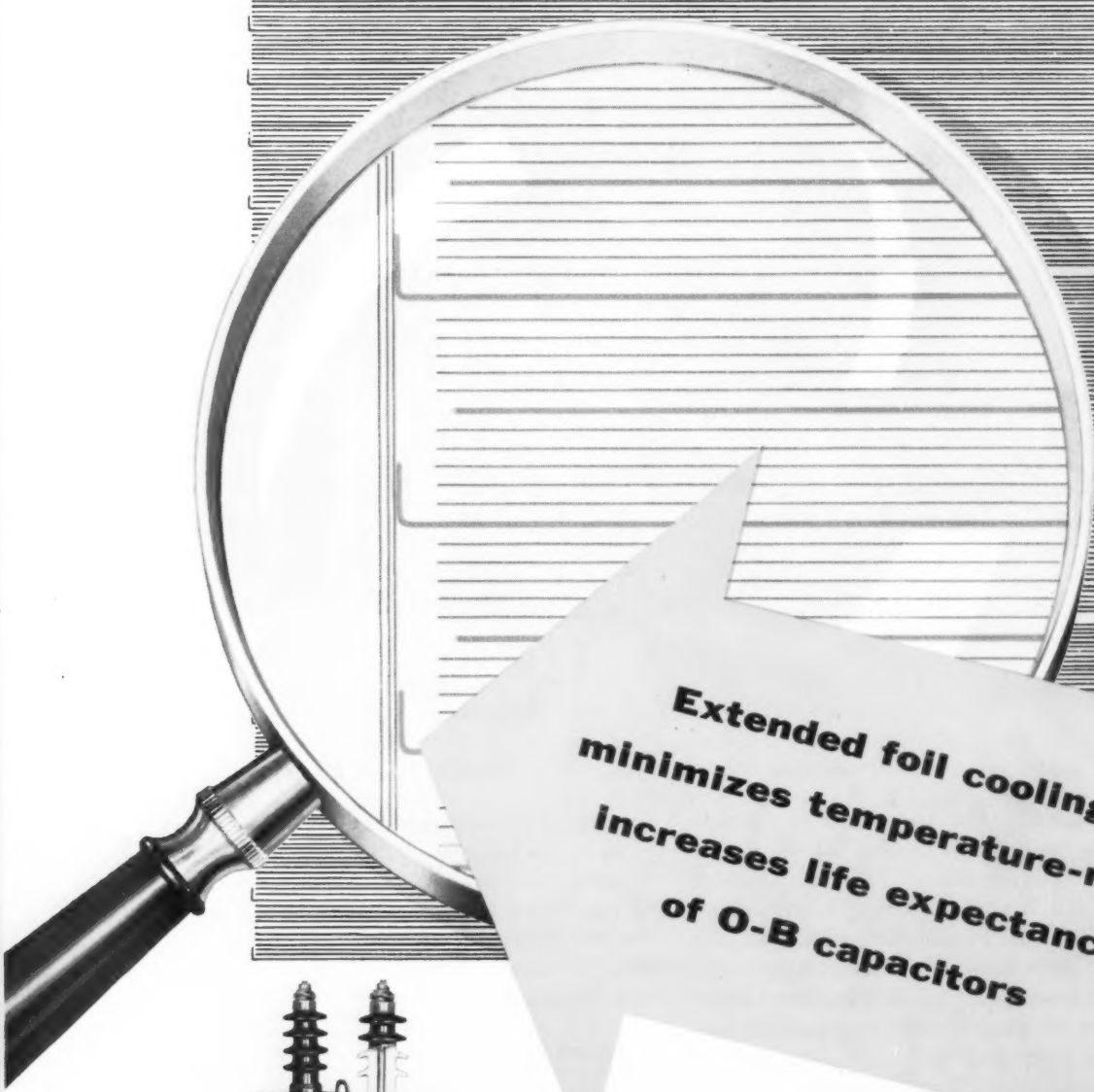
OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B)

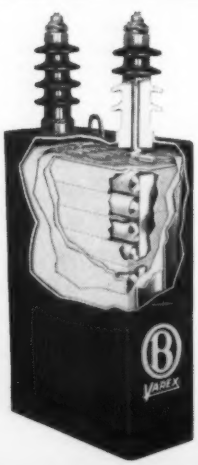
HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

Choose



Extended foil cooling minimizes temperature-rise, increases life expectancy of O-B capacitors



cool VAREX®

for long life

Heat in a capacitor is an inevitable result of its being submitted to electrical stress.

However, the amount of temperature rise can be held to a minimum by design factors, use of quality materials and elimination of contamination.

The design principle responsible for efficient cooling in Varex elements is the extension of aluminum foil at each end of the element. There is an unobstructed path for heat flow from the center to the end of the element. A minimum thermal barrier between element and case also promotes efficient heat flow to the sides of the container.

No one can tell you for sure how long a capacitor will last when installed on your lines. But one of the most important influences on capacitor life is its operating temperature. For every eight to ten degrees centigrade increase in operating temperature, capacitor life is reduced by an estimated 50 per cent. This is particularly important when the ambient or hot spot temperature exceeds the operating limits recommended in Capacitor Standard ASA C55.1.

Foil-cooling, as developed in Varex, is an effective way to hold temperature-rise to a minimum. That's why you can expect longer capacitor life when you specify Varex for your system.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

Just like a third hand!

The 88500 Universal Clamp stays open automatically while the lineman forms and bends the conductor. It remains open until the conductor is in position and the rounded nuts are tightened on the U-bolt. It's just like having a third hand.

Made of corrosion-resistant malleable iron, the 88500 accepts conductors between .20 and .50 inches in diameter. Holding strength is more than adequate for distribution deadends, helped by the snubbing action inherent in the clamping face.

Among other points that save installation time: the high wall along the clamping section which effectively retains the conductor during installation, all operations can be done from one side, and there are no loose parts to worry about.

If efficient deadending of distribution lines is one of your objectives, you can get important help by using the new O-B 88500 clamp.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass HOLAN

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BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

4955-H

DRIVE DEEP WITH Copperweld®

sectional ground rods

Don't jeopardize your overhead line performance by skimping on ground rods. You can achieve reliable, low-resistance ground connections by driving Copperweld Sectional Ground Rods deep into the earth's sub-surface where there are good conducting soils. And by measuring resistance after each sectional rod is driven—allowing for seasonal variation—you can make sure of permanent grounding protection.

Drive deep with Copperweld! You'll improve line performance, promote safety, avoid damage, and assure uninterrupted service.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

YOU'RE POSITIVE WITH THE MOLTEN-WELD

This microphotograph of the weld area of Copperweld Ground Rods shows how the grains of copper and steel alloy to form a permanent, continuous weld. No other process achieves this inseparable union.

The Kariba Dam is being built on the Zambesi River to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether orders for this company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable — at present being manufactured — which will connect the underground power house to the overhead transmission lines. This will be the highest voltage cable ever installed in Africa.

the 330,000 volt Kariba Cable

the highest voltage in Africa

experience

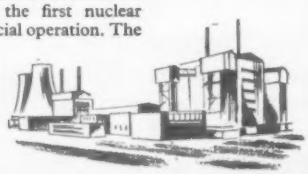
keeps BICC *in the lead*

D.S.O. FOR ECONOMY

The Ductless, Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, it costs less than a conventional cable of equal duty.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables included specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.



THE FIRST I.P. CABLES IN SOUTH AMERICA

In face of fierce international competition BICC 69kV Impregnated Pressure Cables were selected for power transmission in and around fast-growing Porto Alegre, Brazil.

How do you learn about electric cables?

By making them, testing them, installing them, studying them in operation, finding new materials and better designs, and then starting all over again. Years of doing this for every type of electric cable and accessory — that's where BICC's experience came from. Here are some of the results.

BICC the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED

Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.

here's the inside story on Southern States cutouts and boric acid fuse links

While Southern States Distribution Cutouts are designed to function properly with other makes of fuse links, there is a measurable difference in performance when Southern States boric acid links are used—not only in our cutouts, but in other makes, too.

The cutaway view tells the inside story of why Southern States Cutouts and Fuse Links work together to provide the ultimate in fuse protection.

The auxiliary tube of the link is unusually long and sealed to the top ferrule. The fusible element is buried in boric acid powder.

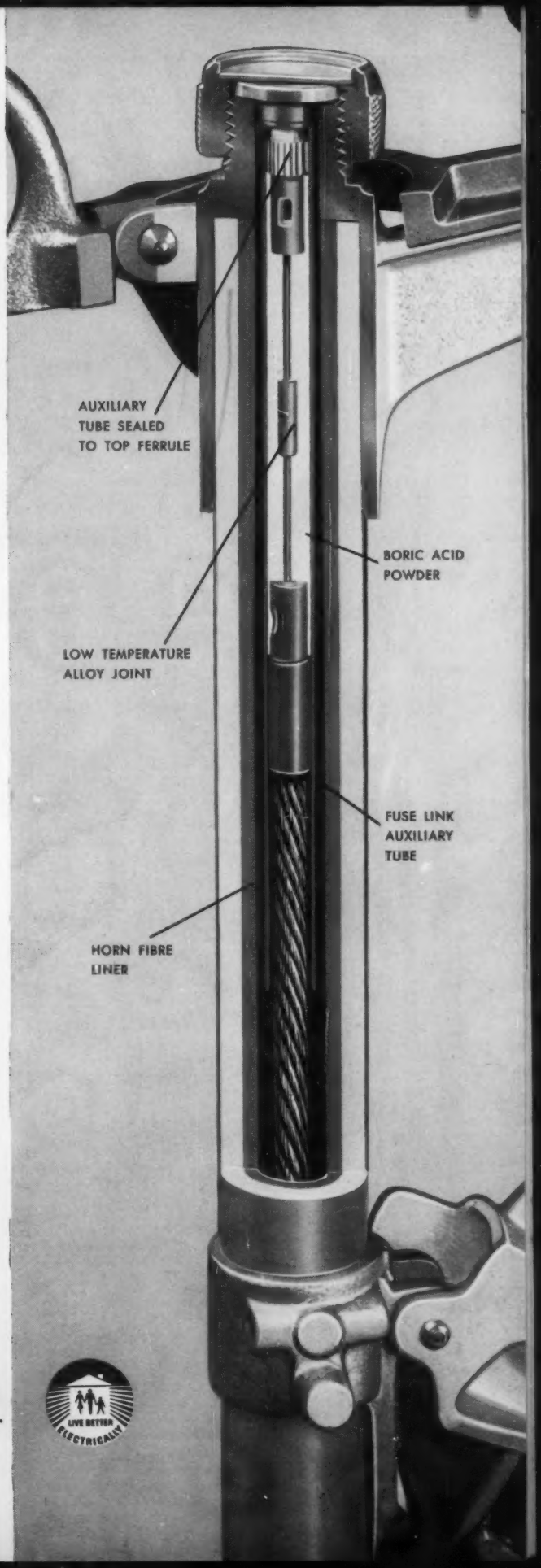
When a fault occurs, even one just sufficient to melt the fusible element, a lot of things happen fast: First, an arc is established when the element separates. The heat generated by the arc instantly converts the boric acid powder into water and then into a large volume of steam. This action performs a dual task. First, vaporization of the water and rapid expansion of gas cools the arc. Simultaneously the arc stream is purged of ionized gas by a fast-moving column of steam.

Circuit interruption is swift and sure.

At higher values of fault current, pressures generated destroy the auxiliary tube. When this happens the same action that occurred in the auxiliary tube takes place in the main fuse tube.

For the ultimate in fuse protection on low or high faults, use Southern States Cutouts and Fuse Links.

Get full information from your Southern States representative, or write for Bulletins 580C and 55PDL.


AUXILIARY TUBE SEALED TO TOP FERRULE
BORIC ACID POWDER
LOW TEMPERATURE ALLOY JOINT
FUSE LINK AUXILIARY TUBE
HORN FIBRE LINER

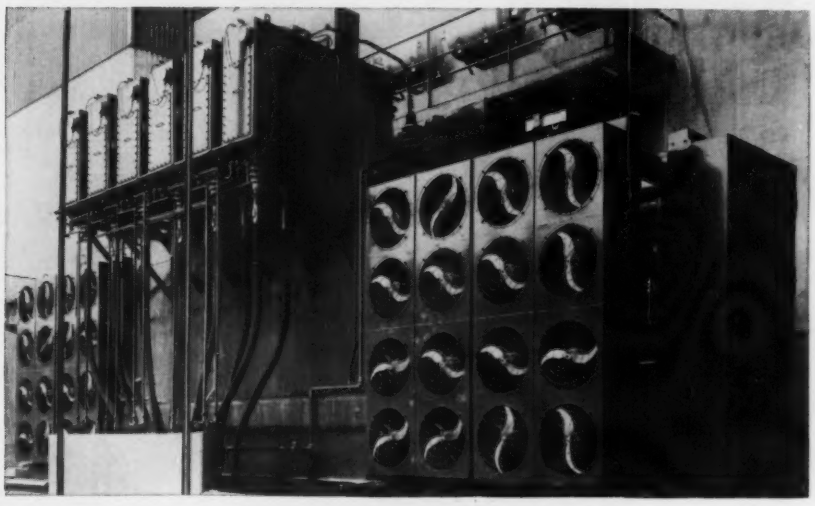
SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

LIVE BETTER ELECTRICALLY

Mr. S. Bennon, Manager, Westinghouse Large Power Transformer Engineering, and Mr. J. D. Goodwin, Large Power Transformer Sales, examine drawing of world's largest generator transformer, installed at Commonwealth Edison's Fisk Station.

Rated at 69 kv, 380 mva, FOA, this Westinghouse power transformer has two 69-kv windings, each rated at 210 mva, and one 17.2-kv winding rated at 380 mva.



WORLD'S HIGHEST INSTALLED CAPACITY

At 380 mva, the Westinghouse generator transformer at Commonwealth Edison's Fisk Station has the highest capacity of any such unit installed.

Here is another step upward toward the super kva banks of tomorrow . . . another step made possible by Westinghouse leadership in power transformer development.

Through the years, Westinghouse design engineers have developed improvements that permit building—and shipping—the higher capacity transformers required by higher and higher generation capacity. Here are some of these developments, and what they mean to the future of electric utilities:

"Form-Fit" construction—Highest mechanical and dielectric strength, to withstand all stresses of shipping, installation and service. Smaller, lighter transformers.

Forced-oil cooling—Increased cooling efficiency, greater capacity from a smaller transformer.

Inner-Cooled construction—Maximum utilization of materials used in conventional transformer construction reduces size and weight up to 15%, permits lower impedances and improved performance.

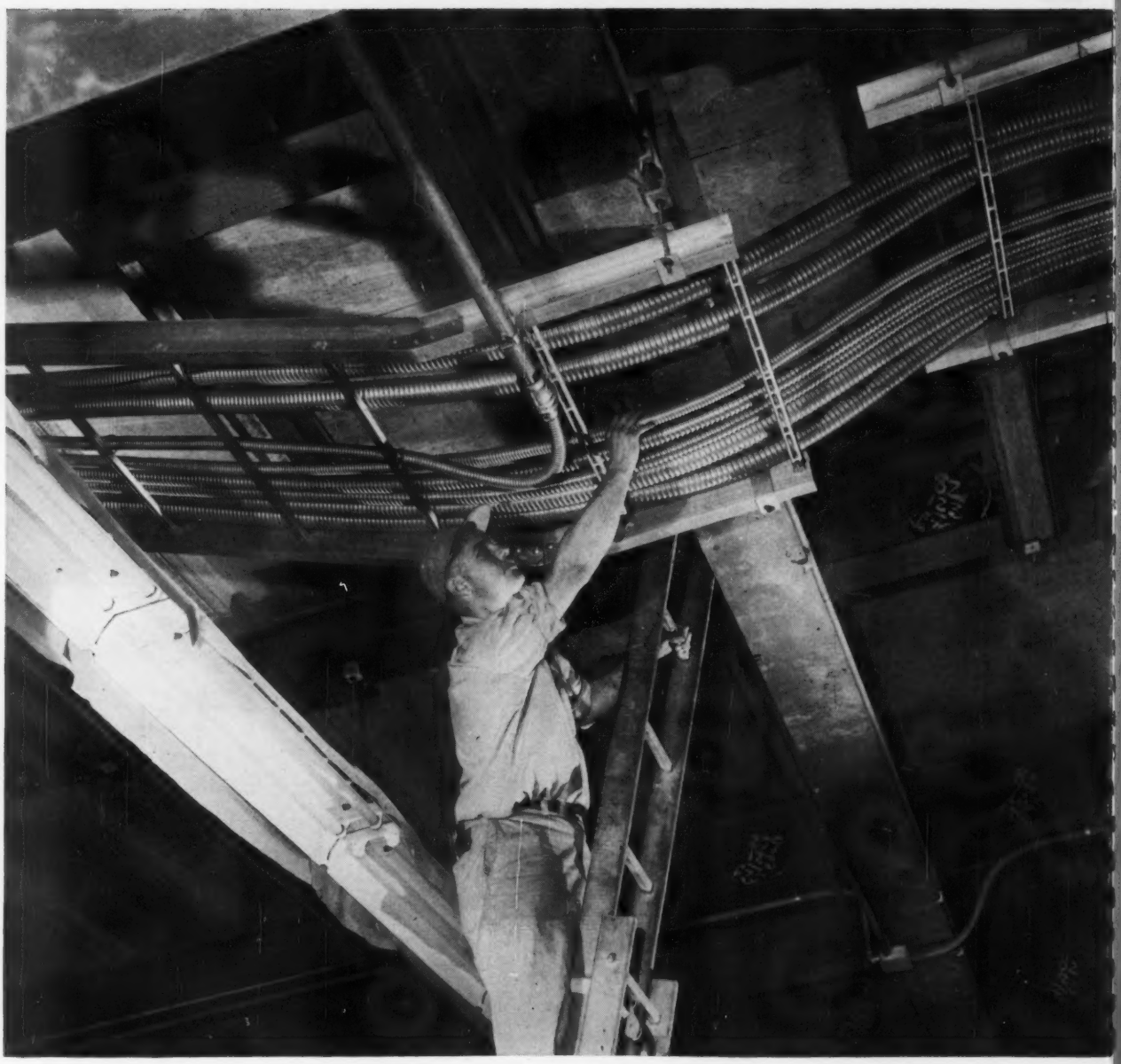
Insuldur* insulation system—Permits an extra 10% overload beyond your present loading practice with no additional loss of insulation life.

And here are other dollar-saving Bonus Values from Westinghouse Plowback of Earnings into research and development. Lower BIL's with savings in original cost, reduced losses, lower impedance and smaller size; vapor cooling, which combines the safety of dry-types with performance of liquid-immersed units.

*Trade-Mark J-70877

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS



Armorlokt Cables are easy to install around bends or obstructions, readily accessible for repairs and are available for indoor and outdoor applications.

USS

Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical cable?

You can install USS Armorlokt in half the time—at half the cost

Take a close look at the main illustration. With Tiger Brand Armorlokt Interlocked Cable, it's a simple job to run power and light lines around a steel beam. We know, from experience on other jobs, that a conduit system would require about twice as much time to install. It would probably have required larger size cable, because of the higher voltage drop . . . *and it would cost about twice as much!*

Greater current-carrying capacity. For a given conductor size, Armorlokt will have a higher current capacity than three single conductor cables pulled into a steel conduit. As an example, 500 MCM 3-conductor varnished cambric cable with galvanized steel interlocking armor will have a current-carrying capacity of 417 amperes with a copper temperature of 85°C. Three single conductors of the same size in a steel conduit will have a current-carrying capacity of 380 amperes. Putting it another way, 350 MCM Armorlokt might serve, where 500 MCM would otherwise be required in conduit . . . a big saving in favor of Armorlokt.

Less material—less space. With Armorlokt, costly pipe fitting, bending and pull boxes are eliminated. Installation time is cut approximately in half. Space savings as high as 55% to 75% over conduit are common.

Greater layout flexibility. When distribution systems are laid out with easily-accessible, readily-traceable Armorlokt Cables, it is a simple matter to change machinery locations. This might well be a deciding factor in industrial plants.

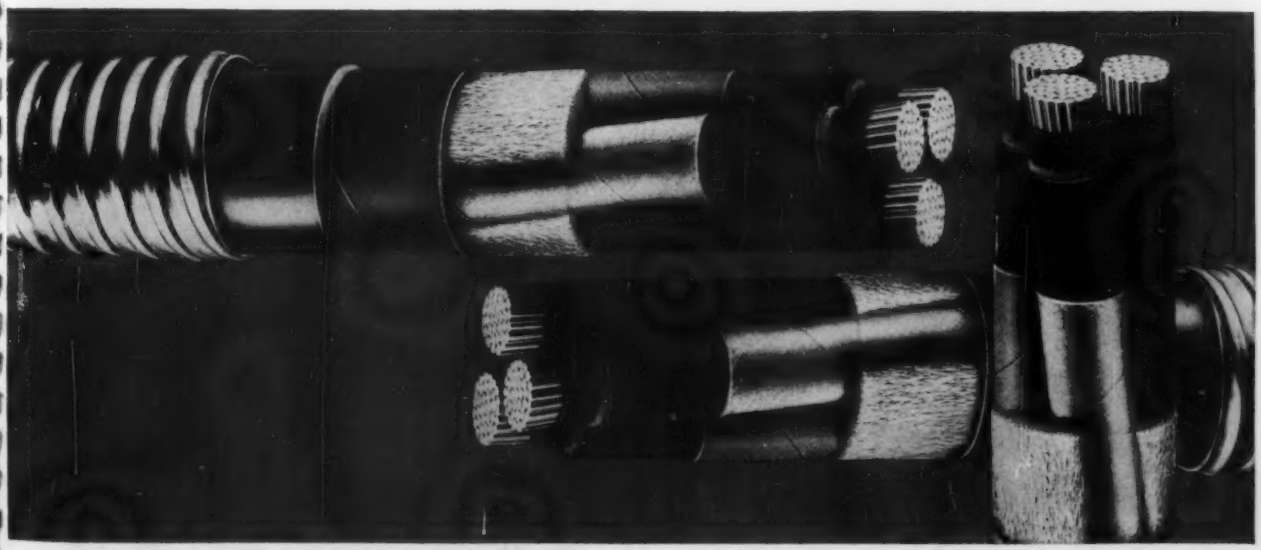
Ease of maintenance. Armorlokt Cable permits the greatest possible ease of maintenance. Cable faults are readily located and serviced. If Armorlokt should become damaged, you simply insert a splice box.

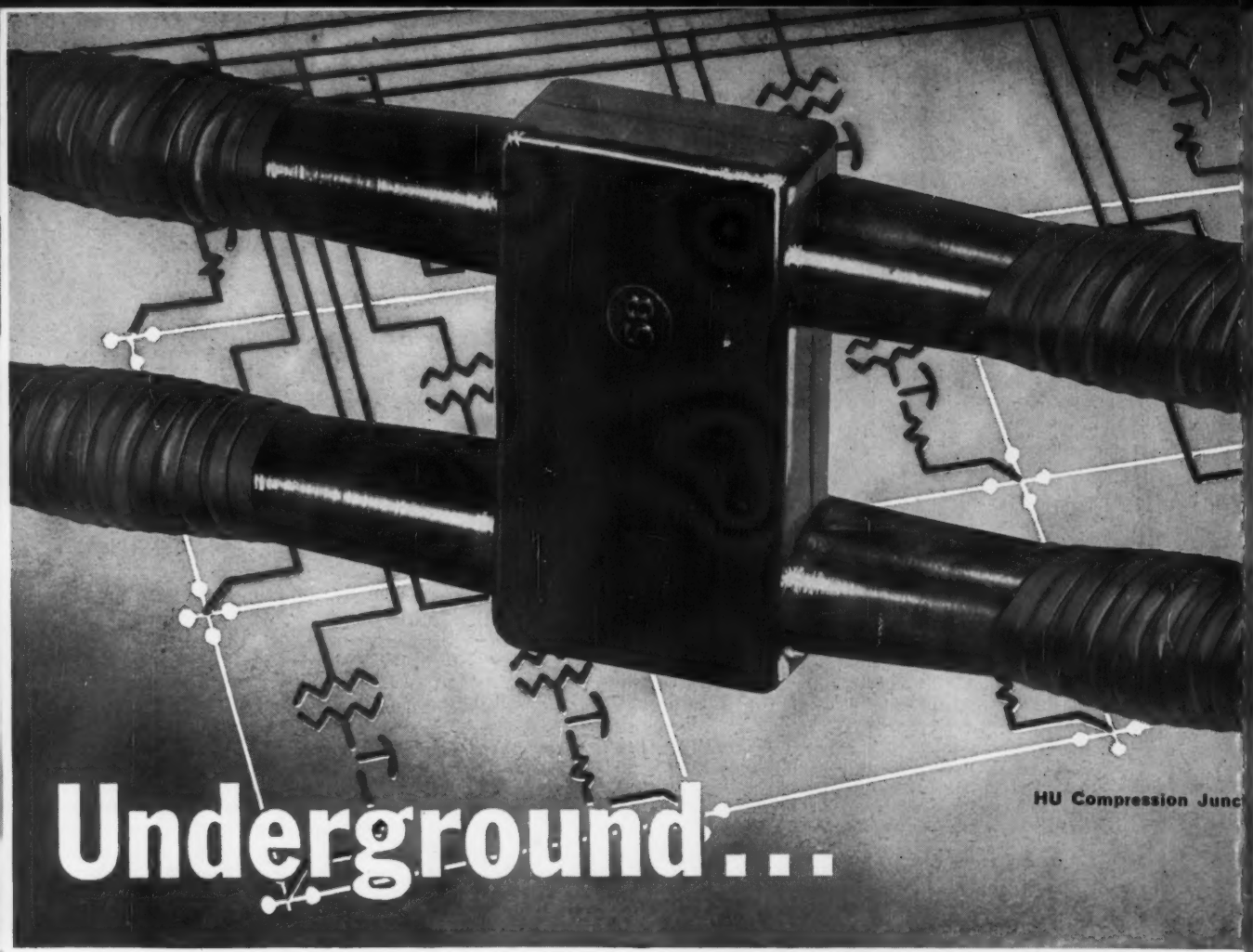
USS Tiger Brand Armorlokt Cable is available in voltage ratings from 110 to 15,000 . . . with galvanized, stainless steel, aluminum or bronze armor . . . with polyvinyl chloride jackets over the armor for especially corrosive applications. For complete facts, write American Steel & Wire, Dept. 980, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS, Tiger Brand and Armorlokt are registered trademarks

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad





Now! Anderson goes underground! In order to round out and complete its connector lines Anderson has entered the underground connector field . . . another forward step by Anderson in its continuing efforts to bring you the most advanced connectors for every application need. Shown here are three of our series of underground connectors. For details on these and other Anderson products write for our catalog or see your nearest Anderson representative.

HU Insulated Compression Junctions: available with four to twelve cable outlets. Designed for joining secondary network cables at junction points. Insulated with P-40 Performite rubber coated with neoprene. May be installed with standard indent tools.

HCL Compression Lugs: sizes to accommodate copper cable from #6 to 2000 MCM. May be installed with standard indent tools.

HCL Compression Lugs

SJA Split Tinned Sleeves: high conductivity copper, hot dip tinned according to latest EEI specifications.

SJA Split Tinned Sleeves

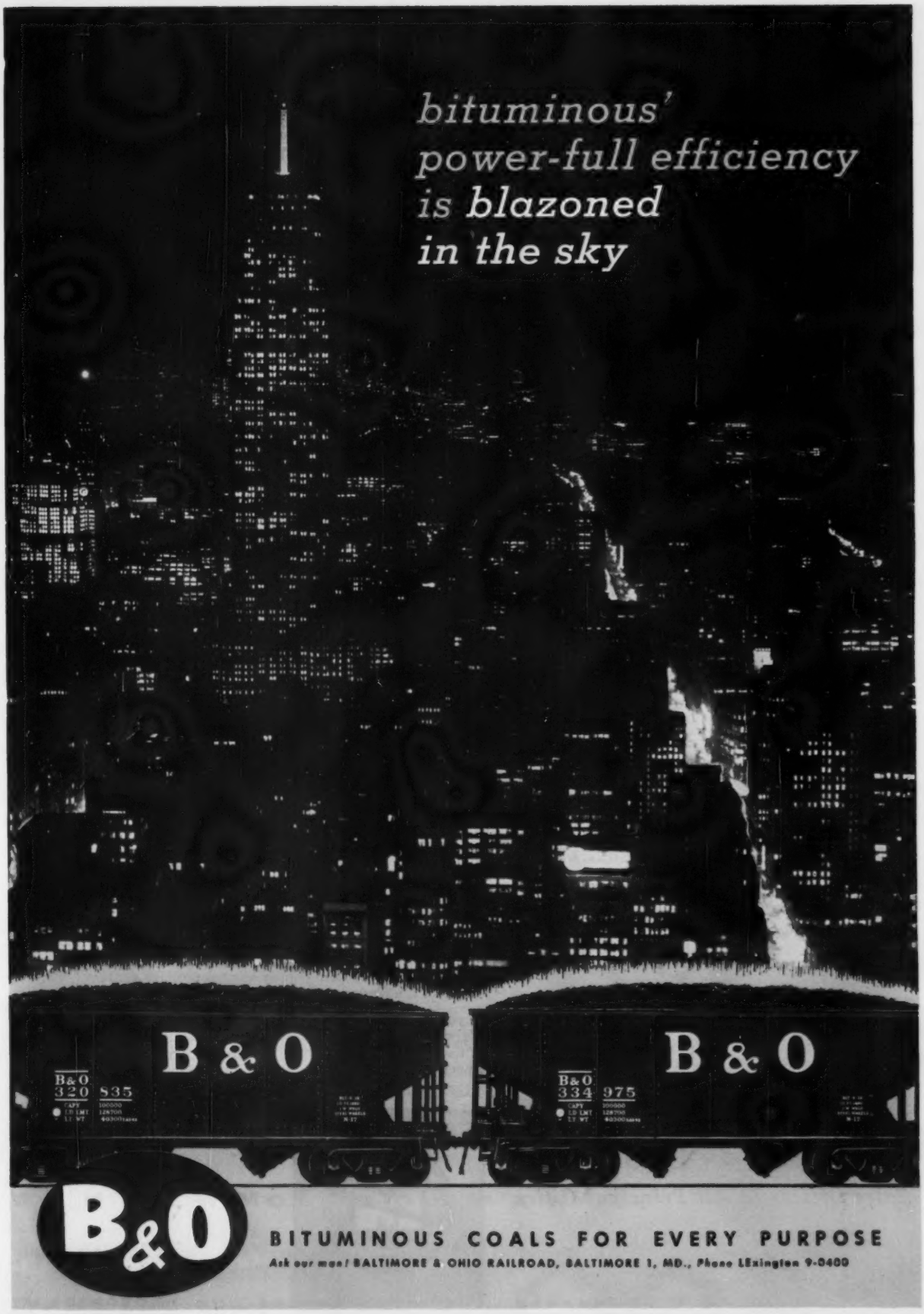
ANDERSON ELECTRIC CORPORATION • Birmingham 1, Alabama
50 Church Street, New York 7, New York

ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

Export Representative: International Standard Electric Corp.

Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION • UNDERGROUND


bituminous'
power-full efficiency
is blazoned
in the sky
B & O
B&O 320 835
B & O
B&O 334 975
B&O
BITUMINOUS COALS FOR EVERY PURPOSE
Ask our man! BALTIMORE & OHIO RAILROAD, BALTIMORE 1, MD., Phone LExington 9-0400

NEW TYPE SWITCH INCREASES THE RANGE OF APPLICATION OF

MOLONEY S-M

Cap provides weatherproof seal and affords ready means of operating the switch.

There are now two Moloney S-M switches and Moloney S-M Transformers are now available with ratings suitable for most any distribution system voltage up to and including 18 KV.

The importance of this development is shown by increased load growth being experienced by most utilities, demonstrating that there will eventually be a need for higher distribution system voltages. When the changeover to higher distribution system voltage is made, Moloney S-M Distribution Transformers will eliminate the need for changing out transformers and will reduce cut-over time to a minimum.

Moloney S-M Transformers are available in sizes up to and including 100 KVA and in both Conventional and CSP types. A few of the many possible combinations of high voltage ratings are listed below:

2400/4160Y x 7200/12470Y, 4800/8320Y x 14400/24940 Grd.Y, 7200/12470Y x 14400/24940 Grd.Y, 4800/8320Y x 7620/13200Y, 4340/7515Y x 7620/13200Y, 4160 Grd.Y/2400 x 13200 Grd.Y/7620, 4160 Grd.Y/2400 x 13800 Grd.Y/8000.

A single operating shaft is brought through the tank wall and the switch itself is mounted on the tank wall above the core-and-coil unit. This method of mounting eliminates any possibility of shaft alignment difficulties. The interior of the transformer is sealed from the atmosphere by seals around the operating shaft and by a gasket in the cap covering the operating shaft.

By means of the operating shaft and the special cap, the high voltage winding of the transformer is reconnected for use on a higher distribution system voltage, quickly and easily, without having to enter the transformer tank. To ready the transformer for use at a higher distribution system voltage, it is only necessary to remove the cap covering the operating shaft, invert the cap, rotate the switch to the proper position and then replace the cap.

The body of the switch is made of wet-process porcelain and the contact blades are beryllium copper. The inherent spring action of the beryllium copper assures positive contact between the blades and the terminal studs.

If your load growth forecasts indicate an eventual need for higher distribution system voltages, investigate the desirability of installing Moloney S-M Distribution Transformers . . . Specify Moloney Transformers . . . All Along the Line. MES9-4

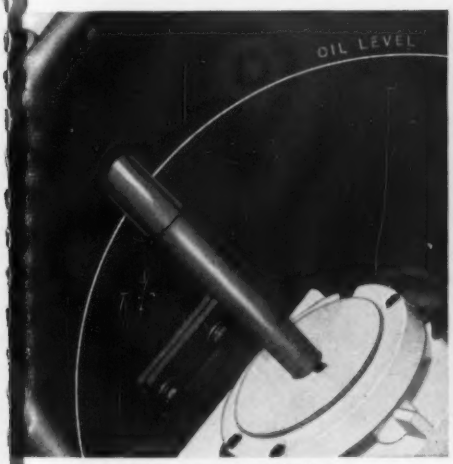
Sales Offices In All Principal Cities

MOLONEY

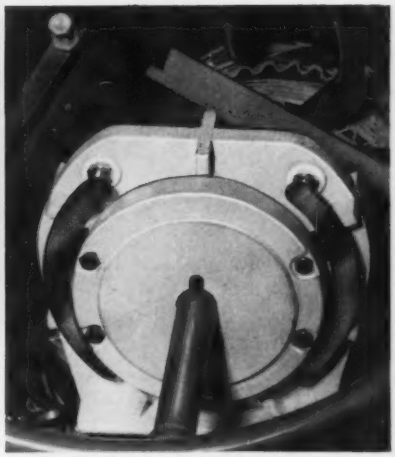
Manufacturers of

FACTORIES AT

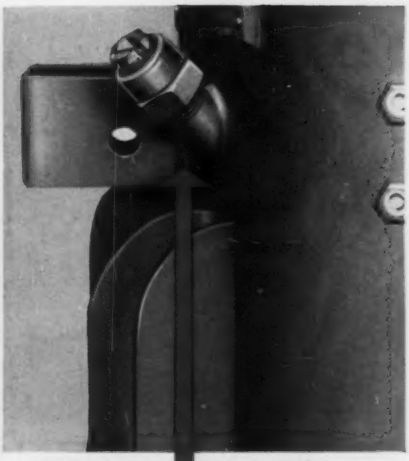
TRANSFORMERS



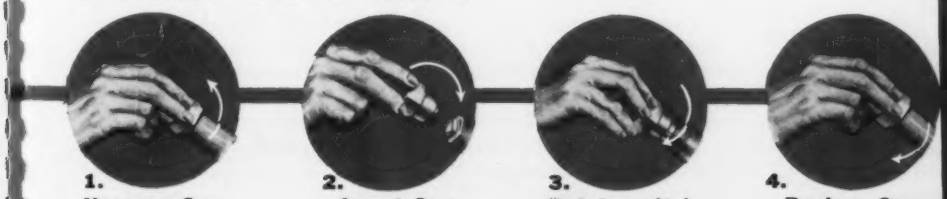
Tankwall mounting eliminates shaft alignment difficulties.



Switch contact blades are beryllium copper and body is wet-process porcelain.



4 SIMPLE STEPS

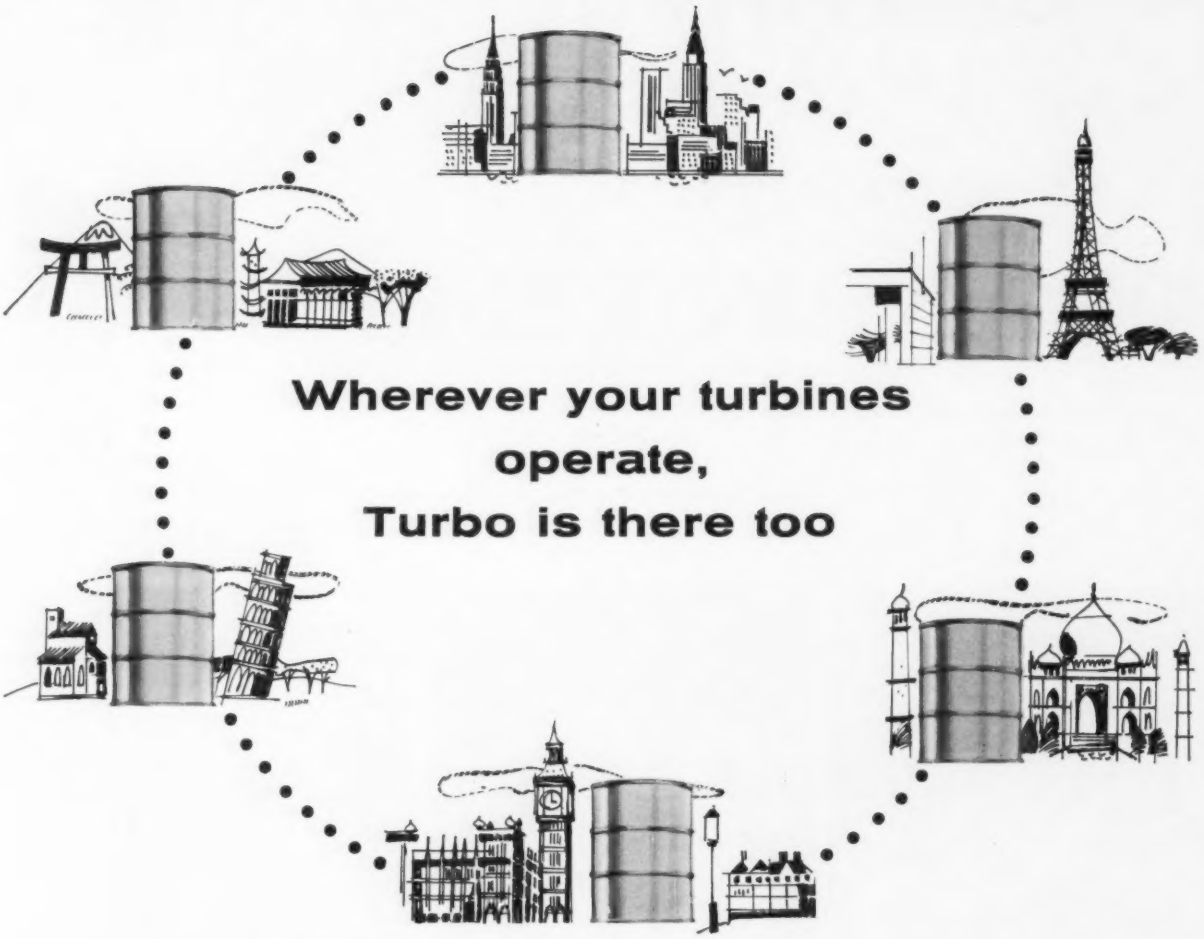


1. Unscrew Cap
2. Invert Cap
3. Rotate switch to proper position
4. Replace Cap

ELECTRIC COMPANY

Transformers for Utilities, Industry, and Electronic Applications

ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA



Wherever your turbines operate, Turbo is there too

Its performance and name are the same around the world

Other outstanding Shell Industrial Lubricants

Shell Tellus Oils—for hydraulic systems

Shell Alvania Grease—multi-purpose industrial grease

Shell Rimula Oils—for heavy-duty diesel engines

Shell Talona R Oil 40—anti-wear crankcase oil for diesel locomotives

Shell Dromus Oils—soluble cutting oils for high-production metalworking

Shell Macoma Oils—for extreme pressure industrial gear lubrication

Shell Voluta Oils—for high-speed quenching with maximum stability

Shell Turbo Oil is now available to your customers in foreign countries. Because of this universal availability, you can be sure your equipment will give the same performance that your domestic customers enjoy.

Turbine-manufacturers' and turbine-users' reports prove that Shell Turbo® Oil is outstanding in oxidation stability and rust protection. In addition, this oil has special properties to insure adequate lubrication of the highly loaded gears in ship propulsion and industrial applications.

Wherever your turbine equipment is installed, make Shell Turbo Oil your standard recommendation. For more complete information, write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.

SHELL TURBO OIL

the universally preferred turbine lubricant

SHELL

New Electric Generating Station for Memphis Equipped with Phelps Dodge Condenser Tubes!

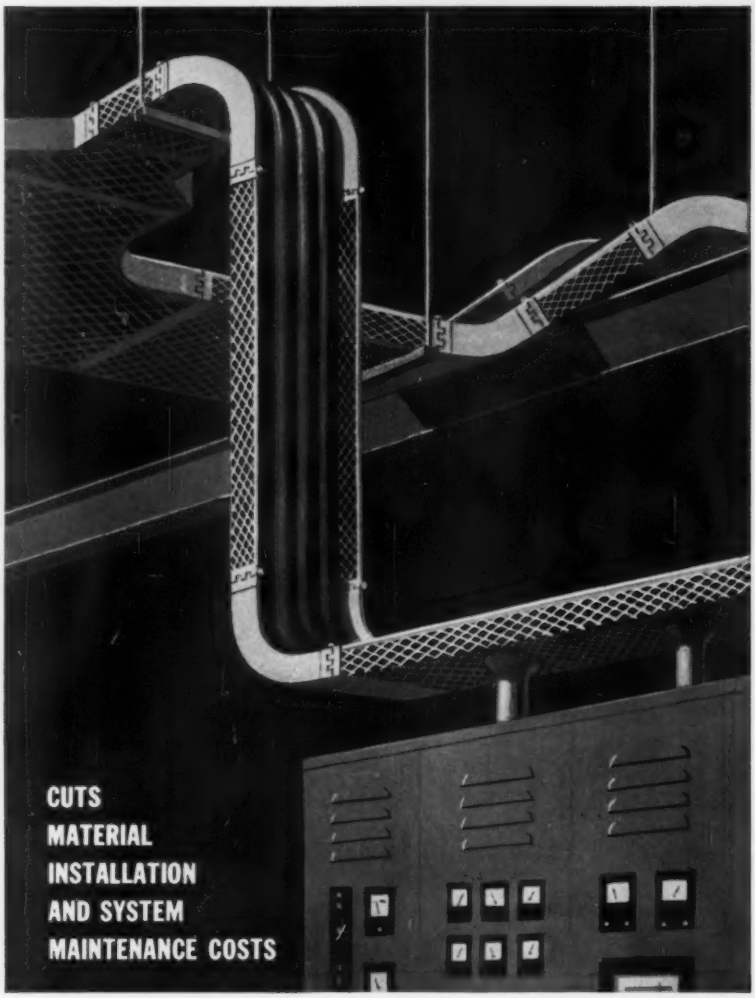
The new Thos. H. Allen Electric Generating Station of the Memphis Light, Gas & Water Division, City of Memphis, Tenn., is designed to answer the need for increased electric power in Memphis and surrounding Shelby County. This mammoth plant, designed by Burns and Roe, Inc., and constructed under their supervision, has three hydrogen-cooled turbine generators and three multiple-pass condensers, with a new capability of 812,500 kilowatts.

Within the condensers are more than 298 miles of Phelps Dodge Admiralty condenser tubes, weighing about a million pounds. These 30-foot-long tubes help each unit condense steam from the generators at the rate of over one million pounds per hour. Each condenser has a heat transfer-rate of 980 BTU per pound of condensed steam.

Phelps Dodge condenser tubes are known for lasting quality and expert workmanship in industries using heat transfer equipment. This reputation has made Phelps Dodge a leading manufacturer of copper and copper-alloy tubes for the fabricators of condensers and heat exchangers.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N. Y.

COPE
WIREWAY
FOR POWER CABLE DISTRIBUTION



A single run of Cope Wireway supports as many cables as several runs of conduit. Exclusive pin-type coupler assures quick, easy installation of lightweight aluminum or galvanized system components—even in cramped quarters. Cables are easy to get at for inspection, re-routing or system expansion needs.

ORIGINATORS OF THE FIRST INTEGRATED LINE OF CABLE SUPPORTING SYSTEMS

COPE

FACTS AND FIGURES FOR UTILITIES

250 TONS OF STEEL SAVED
—at Jersey Power Station

PROBLEM

Select system equipment to support over 100 miles of cable at New Jersey power generating station.

SOLUTION

Careful cost analysis of available methods and materials convinced engineers on the job that Cope's expanded metal wireway was the best choice. Why? Among other reasons, it meant a saving of more than a ton of steel for every 60 feet of wireway installed, as compared to conduit . . . a total saving in excess of 250 tons of steel for the 15,000 feet of wireway required for the complete job! Expanded metal wireway simply uses *less* steel to do the job—and this adds up to real economy regardless of the size of your installation.

ASK FOR PROOF! **Get additional cost saving details from Cope for your next cable installation. Contact an Authorized Cope Electrical Wholesaler—or write for detailed Engineering Data.**

COPE SUPPORTING SYSTEMS SOLD *ONLY* THROUGH *AUTHORIZED* ELECTRICAL WHOLESALERS

5048

Makers of . . . Cope Cable Ladder, Cable Channel and Controlway . . . the Lowest Cost Support for Low Voltage Control and Signal Circuits. Also a Complete Line of System Supports and Accessories.

Division of **ROME CABLE CORPORATION**
COLLEGEVILLE, PENNSYLVANIA

Question:

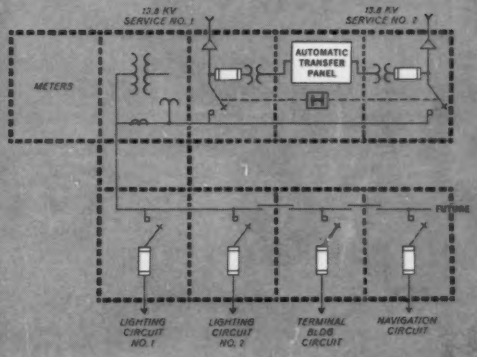
Why did Greater Cincinnati Airport use S&C Metalclad Switchgear in its high-voltage power system?

Answer:

There was *only one answer* to the requirements of maximum reliability, continuity of service, adequate short circuit protection, and full load switching, all at low cost —S&C Fused Load Interrupter Metalclad Switchgear.

Q: Why are power fuses and load interrupters used to replace circuit breakers in this type of switchgear?

A: Because conductors in such installations as this modern airport run in protected underground conduit and tunnels, and are not subject to transient faults caused by trees, wind, or rodents; protection against permanent faults is the only kind needed—and this is provided by S&C Power Fuses.



Q: How is automatic preferred-to-emergency transfer for service continuity provided in this S&C Metalclad Switchgear equipment?

A: By means of an S&C Standard Automatic Transfer Panel used with Moto-Draulic operator, a variety of throwover schemes is available at the flip of a switch. This transfer panel provides for making either source preferred; choice of automatic or manual return; choice of time delay (up to 10 minutes); and optional manual operation of line switches.

Q: Why can S&C offer savings up to 50% in this modern switchgear and still meet the highest standards of quality?

A: Because of the inherent simplicity of the S&C Fused Load Interrupter (compared to complex circuit breaker equipment), savings of 50% and more in the initial cost of switchgear equipment can be realized while the highest quality standards are maintained for the installation.

Q: How can you get information about such switchgear?

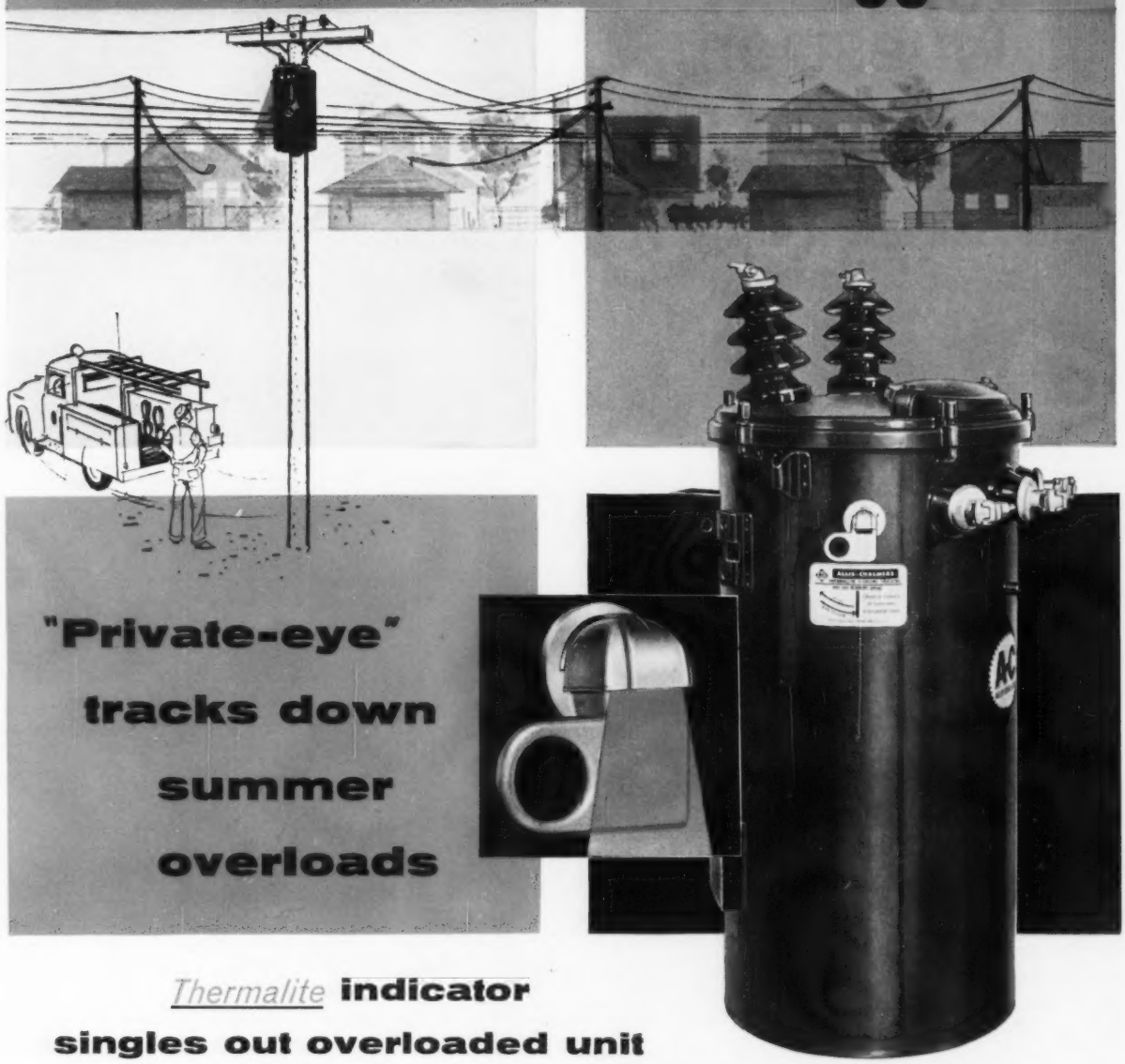
A: From S&C sales offices in principal cities. Consult your telephone directory.

S&C ELECTRIC COMPANY
4421 Ravenswood Ave., Chicago 40, Ill.

S&C

Specialists in High-Voltage Circuit Interruption for Electric Utilities Since 1910

ALLIS-CHALMERS modern line for '59



"Private-eye" tracks down summer overloads

Thermalite indicator singles out overloaded unit

Plan to stay ahead... MODERNIZE!

With the *Thermalite* indicator doing your gum-shoeing, you can spot overloads the easy way — from a cruising service truck. The need for expensive surveys is eliminated. Replacement or any other system change can be made at your convenience.

Greater Utilization

You can stretch transformer dollars by taking advantage of inherent overload capabilities of distribution transformers. *Thermalite* indicators let you use this capability without disrupting service continuity. For complete information, call your A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Thermalite is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-5998-E

MAY 11, 1959

Congratulations AIEE On Your 75th

Electrical World looks back with pleasure to those early months of 1884 when we were publicizing the activities of and giving assistance to those electrical engineers who were organizing the American Institute of Electrical Engineers. And we extend our warmest congratulations to the society as it exists today. Certainly the AIEE can take a great deal of credit for its supporting role in the technological developments of the past 75 years. In power, communications, electronics, and industrial power fields AIEE has provided the necessary technical committee and meeting structures. Through them the top minds of the profession have been able to exchange view points and extend the boundaries of engineering knowledge.

Today, with 55,000 members, 56 technical committees and several hundred subcommittees, AIEE should easily stand on the threshold of renewed growth and service. We hope that this proves to be the case. And we are sure it can be if AIEE is able to remain sufficiently flexible to move ahead.

In celebrating the 75th Anniversary, Institute members might well look back for guidance and re-evaluation of AIEE's basic objective. For one thing, they should be reminded that AIEE was founded by men of great stature—such men as Dr. Norvin Green, president of the Western Union Telegraph Co, and Rowland R. Hazard, president of the Gramme Electric Co. Dr. Green was the first president and Thomas A. Edison and Alexander Graham Bell were among six vice presidents. Does the Institute draw its share of industrial and professional leaders into its management today?

The objectives of AIEE do not imply that a member must necessarily be an electrical engineer by profession. The statement of objectives provides for "the advancement of the theory and practice of electrical engineering and the allied arts and sciences . . . ". This leaves ample room for much broader activities than many of today's members are willing to recognize.

In the course of years, many splinter groups have been formed. They have grown and prospered because their youthful imagination permitted full use of the new and untried. Perhaps this youthful flexibility needs to be reinstated in AIEE.

Then there is always the possibility of bringing the splinter groups together in an all inclusive electrical society. Does AIEE have the will to lead such a movement and the flexibility to accept the organizational adjustments that would be necessary?

We believe AIEE can move forward. But in celebrating seventy-five years of successful service to the electrical engineering profession it should not lose sight of the problems of today and tomorrow. May they receive due attention as part of this celebration.

ATTENTIVE at sessions and articulate in interviews and bull sessions, the 350 student delegates (55 of them girls) came from 36 states as guests of 68 power companies

AEC EXHIBIT was visited by virtually all the 673 persons who registered for the two-day Atlantic City meeting. Utilities with A-projects under way also set up exhibits

Students, Teachers, Sponsors Agree:

"The whole thing has exceeded expectations."

This comment, with only slight variations, sums up the reaction of both sponsors and participants in one of the most effective programs ever undertaken by electric utility companies.

For a number of companies paying expenses for the high school delegates and their teachers, the first national Youth Conference on the Atom generated unprecedented interest and enthusiasm on local fronts. And one index of the two-day Atlantic City meeting's national impact was the support and good wishes extended by educators, science, and atomic groups and President Eisenhower.

The President telegraphed the 350 youths, 250 teachers and representatives from the 68 sponsoring power companies: "This conference provides an opportunity for students to gain a new appreciation of the progress our country has made and will continue to make in bringing the constructive aspects of atomic energy to mankind. I hope that many of them will be inspired to take up careers in this and other promising areas of science."

The youngsters' remarks to Voice of America staff men, interviews taped for a nation-wide radio network airing, and comments to other news media people covering the sessions strongly indicated the President's hope would be realized.

Poised, polite, and articulate, the students (some 55 of them girls) were chosen for the trip on the basis of science scholastic tests and grades. In most instances school officials selected the delegates, who came from 36 states.

Spokesmen for Bozell & Jacobs, Inc, the public relations agency handling the Public Information Program, said plans for subsequent conferences hinged on a review of the opinions of participating companies and their guests. "From what we've learned already," a B&J executive said on the opening day, "future meetings appear to be a certainty." About one-third of the sponsoring companies are not PIP members, he added.

At this first get-together, an erudite corps of speakers made it even more of a once-in-a-lifetime occasion for the young men and women.

Sharing honors for the most warmly received talks were Commissioner John F. Floberg, Atomic Energy Commission, and Dr James Creese, president, Drexel Institute of Technology.

The commissioner, in defining the legal responsibilities and departmental functions of the AEC, stirringly advised the students: "Don't let science stand in the way of your education." He urged that study of government, humanities, art and foreign languages be included in their schooling. The U. S. needs not only their leadership in science but also in helping administer the affairs of a democracy endangered by communism from without and by ignorance and indifference from within, he told the youngsters.

U.S.S.R. Threatens Scientific Lead of U. S.

Dr Creese warned "There is no reason to assume that the U. S. will maintain its lead over the U.S.S.R." if we ignore the need for broadened support of "the new disciplines of science and technology." If we lag in science—"and I think we are close to failure—we shall have ourselves to blame as students and teachers, industrialists and citizens." He defined the function of schools as "teaching and selecting." Few schools are performing the selecting function well, he said.

A fascinating look at the year 2,000 was previewed with slides and comments by Charles Weaver, Westinghouse Electric Corp vice president, and Francis McCune, General Electric Co vice president. Their joint presentation ranged from push-button cooking and electric vehicles to space breakthroughs and nuclear-powered aircraft.

In the keynote address, Dr Alan Waterman, director, National Science Foundation, said one responsibility of youth is to help restore the prestige and financial rewards of teaching.

Robert Ginna, Rochester Gas & Electric Corp board chairman, outlined nuclear developments under way by public and private groups and predicted that 25%

LOOK AHEAD at year 2,000 by Charles Weaver, nearest camera, of Westinghouse and GE's Francis McCune was followed by intensive Q&A session with future scientists

TOP LINE-UP of speakers included AEC Commissioner Floberg. On his right is Dr J. Kaplan, U. S. chairman for IGY. On Floberg's left is E. M. Naughton, meeting chairman

Atom Youth Conference Is a Hit

of total generation in 1980 would be from atomic fuel.

A panel on industrial, agricultural and medical uses of the atom was well received. It included Charles Robbins, Atomic Industrial Forum; Dr Cyril Comar, Cornell University; and Dr John S. Laughlin, Sloan-Kettering Institute for Cancer Research.

A show called "The Fabulous Atom" was presented by Public Service Co of Colorado (EW, Aug. 18, p 90).

Trip Provides Some Notable 'Firsts' and Facts for 350 High School Delegates

Mary Lois Schroer, 17-year-old student of Mother of Mercy High in Cincinnati, rated the meeting an unqualified success. She had read about the conference but was still finding it difficult to believe she actually was taking part. "I hope to be a nurse, so I especially liked the talk on medicine," she said. The trip afforded Mary several important "firsts." These included the airplane ride, a tour of Washington, D. C., and her first view of the Atlantic. She was accompanied by four students, two sisters and two priests. Sponsor was Cincinnati Gas & Electric Co.

James E. Jones, 18, of Wichita Falls (Tex.) Senior High, agreed that the conference's objective of stimulating interest in the atomic field had been achieved. "We've learned a lot," he and a co-student said. They liked talks that detailed the atom's impact on agriculture, medicine and industry. As will most of the delegates, the boys will describe trip highlights of the program to their school's teachers and some individual classes. Texas Electric Service Co was host for the boys. They were joined by Howard Drew, an official of Texas' atomic research group.

Richard W. Holder, 17, a junior at Grand Junction (Colo.) High, benefited from talks that dealt in detail with technical matters, he said. The sessions were termed "informative and very smoothly run." And the meeting itself provided a "wonderful opportunity" to learn about the field from the nation's top scientists and technologists. Dick, three other Colorado students, and one teacher were guests of Public Service Co of Colorado.

John Martin, 16-year-old junior of John Marshall High School in Rochester, N. Y., was impressed by widespread U.S. interest in and work on peace-time uses of the atom. The meeting's success in bringing together information and various thought on the field was one point he liked. A member of Rochester Gas & Electric Corp's group of three students and two teachers, John intends to become a physicist.

75th Anniversary committee completes plans for . . .

Founders of AIEE to Be Commemorated

A Founder's Day luncheon will be one of the highlights of the 75th Anniversary of the American Institute of Electrical Engineers at the Hotel Astor on May 13.

The luncheon committee, above, is shown at work on the final arrangements. From left to right, they are: Arthur H. Moore, General Electric Co; W. T. Rea, ex officio and chairman of the New York Section of AIEE, Bell Telephone Laboratories; Arch J. Cooper, chairman of the luncheon; Willard Warren, Holophane Co, Inc; A. B. Giordano, Polytechnic Institute of Brooklyn, and Amos E. Joel, Bell Telephone Laboratories.

Western Union Chief to Talk

The speaker at the luncheon will be Walter P. Marshall, president of the Western Union Telegraph Co. The luncheon will commemorate the initial organization meeting of the AIEE held in New York City on May 13, 1884, when another president of Western Union, Norvin Green, was elected the institute's first president. Among those who brought about and attended this first gathering in the offices of the American Society of Civil Engineers on East 23rd Street, were Thomas A. Edison, Alexander Graham Bell, Edward Weston, and Elihu Thompson (one of the founder's of the General Electric Co).

Original membership was 71. Today it numbers more than 52,000 with members in practically every country in the world. It also has more than 7,000 student members.

The anniversary theme adopted by the institute is "75 Years—a Prologue to the Future." It was kicked off at the General Meeting of the institute in Sacramento, Calif. in August, 1958.

Some of the other celebrations throughout the year will be:

- A dinner on May 12 in Boston.
- A celebration at the summer Pacific Meeting, Seattle, Wash., June 22-26.
- A celebration to commemorate the first meeting of the institute to be held at Franklin Institute, Philadelphia, Pa., on Oct. 7.

Study Starts on Gas Turbines, Diesels

Two large gas turbines and a diesel unit will be tested in Philadelphia Electric Co's evaluation of "peak shaving" to hold down costs of serving system peaks. The suburban installations will permit shaving on transmission and on conventional generating plants.

One gas turbine, a 20.5-Mw simple-cycle unit recently ordered from General Electric, is designed for unattended operation. The other, a 22-Mw unit described by Westinghouse as "the largest ever ordered for utility service in the U. S.," will also be a simple-cycle machine. Both are scheduled for service in late 1961 or early 1962 and will run on distillate or available gas.

The General Motors diesel unit has been under test since February. A package-type, remote-controlled, unattended installation, it is expected to supply 6 Mw during peaks. Limited to 4.2 Mw until superchargers are installed, the unit has picked up rated load in less than 60 sec from a cold start.

Duquesne Light Co also is looking to gas turbines for peaking service. According to Board Chairman Fleger, such units of about 25-Mw capacity "are expected to cost substantially less per kw than base load units. They can be equipped for remote starting and stopping. If they prove advantageous, they will permit a material reduction in the company's financing program in the next three years."

This program, costing $35 million annually through 1963, would have included a new 172-Mw steam unit at Reed Station. Recourse to gas turbines for peak capacity will postpone need for the base load unit.

IRS Expands Easement Ruling

If less than cost of land, property owner's payment is not taxable; Wisconsin debates new condemnation code

The Internal Revenue Service, in a new ruling, pointed out last week that a property owner may retain title to his land on which an easement had been sold to build a small dam.

The question involved was whether such a sale also resulted legally in the conveyance of ownership of that land to the party buying the easement. In the specific case involved, the IRS said title to the land remained with the original owner because he had kept "more than a naked legal title" to the land—payment of taxes plus retention of mineral and mining rights.

In issuing the new ruling, the IRS stated that payments for the easement totaling less than the cost of the land involved would not be taxable, but would be used only to retire the investment on the land. However, payments in excess of the cost of the land would be taxed as income.

The new ruling (IRS 59-121) expands and clarifies a previous ruling (IT 26-21), issued in 1932, which limited the question of easements to power transmission lines.

Utilities Oppose Code Proposal

Last month in Milwaukee a stormy hearing before the state assembly and senate judiciary committees found electric cooperatives and power companies allied against a proposed condemnation code. They contended that the bill would raise utility rates and hamper industrial expansion.

The measure stems from complaints by farmers that injustices have resulted from condemnations, particularly these proceedings involving property acquired for highways. The bill would attempt to guarantee that owners be fully informed about the need for their property and that original offers reflect appraised fair market values plus both tangible and intangible damages.

If passed, the new code will require condemnors to issue a relocation order with a map showing property needed. They will have to get an independent appraisal, then send a "jurisdictional offer" to the owner. Property owners could appeal the offer to the circuit court anytime within two years.

Proponents of the measure blasted a state estimate that the code would add $4 million a year to state condemnation costs. Said a Farm Bureau lobbyist: "That statement is a self-indictment that they have been underpaying landowners by $4 million a year."

The *carte blanche* proviso on damages raised the argument that property owner appeals would jam the courts and create snags on price offers that federal authorities also must approve.

Co-op and power company representatives urged that the legislators adopt a code amendment which, in effect, excludes utilities.

POWER BRIEFS

Safety studies on new reactor types should be handled by AEC's Advisory Committee on Reactor Safeguards, while proven types should be in hands of the commission staff. This was proposed by Francis K. McCune, General Electric Co vp at hearings before Joint Committee on Atomic Energy. He called present procedures of two reviews by the advisory group "extremely burdensome."

FPC filings recently include amended license application by Virginia Electric & Power Co for its $47-million, 200-Mw Gaston dam on the Rbanoke River; Pacific Gas & Electric Co's request for a license to rebuild its Stanislaus Plant to up capacity from 40 to 81.9 Mw; Washington Public Power—a federation of public utility districts—seeks a license to build a 20-Mw dam costing $5.5 million on Lake Creek in Lewis County; and Chugach Electric Assn. Inc, asked for a preliminary permit to study proposed $4-million, 10 to 12-Mw dam on Kenai Peninsula.

Nuclear power will provide equivalent of only 50-million tons of coal for electric power generation by 1975, Philip Sporn predicted in National Coal Policy Conference speech. Meanwhile, coal will have to supply 475-million tons for generation and some 425 million tons for other uses by 1975, the American Electric Power Co president said. By 2,000 the atom may provide as much as 21% of U.S. estimated energy requirements while coal will provide 30%.

Spring lumbering of its forested Mongaup River Valley properties yielded some 352,000 board ft of white pine and 25,000 board ft of hemlock for Orange & Rockland Utilities, Inc. It was the first sound of ax and saw in the 15,000-acre tract in New York State in more than 30 years.

REA loan request of $9,825,000 by Sulphur Springs Valley (Ariz.) Electric Cooperative includes $7.5 million for a steam plant to be located at Wilcox.

"Iowa Grid," which interconnects the state's power companies, is in initial period of operation. Sutherland Dows, head of Iowa Electric Light & Power Co, explained in a recent letter to stockholders how the 1,364-Mw pool benefits his company and Iowa-Illinois G&E, Iowa P&L, Iowa Public Service, and Iowa Southern Utilities.

TVA distributors increased sales 425% from 1946 through 1958, the agency has announced. Average rate per kwhr paid by consumers declined 22% in same period and total number of consumers increased 119% to a total of 1,363,311. Distributors' residential sales in 1958 totaled over 9-billion kwhr, an increase of 773% over 1946.

PEPCO Increase Provides 5.85% Return

Year-end rate base used to determine 7% rate hike; revenue need underscored by drop of equity ratio from 38 to 30%

Potomac Electric Power Co has been granted a 7% increase in rates from the District of Columbia Public Utilities Commission. The rates were designed to produce a 5.85% return on the year-end rate base. Pepco had stipulated previously that it would not ask for a greater return than that granted to it in 1955, which was also 5.85%.

Further Increase Will be Sought

This increase, however, was to be considered an emergency one, and the company said it would apply later this year for a further incease.

While the PUC denied the request, the company's proposed $5-million a year hike was granted in all other respects. The need for additional revenues was highlighted by the fact that because of recent heavy debt financing the equity ratio had declined from 38.7% to 30% as of the end of 1958, and there was need to issue additional new capital stock.

Pepco had been using the provisions of Section 167 on a flow-through basis, and the order said that "the rates of return earned for the years 1956, 1957, and 1958 were increased respectively by .08%, .28%, and .37%, by reason of the company's election to avail itself of the advantages of rapid depreciation . . . and permitting the resulting benefits to flow through to net operating income and to income available for return on equity capital. Had it not been for this voluntary action on the part of the company, the requirement for increased revenues in the present proceeding would have been increased by $2.5 million over and above the requested increase . . ."

The intervenors pointed out that, with the growth of the company and the use of flow-through method under Section 167, additional benefits would be provided obviating the need for an increase in rates.

The need of the year-end rate base was also attacked, both by the intervenors and by the PUC staff.

The order said that the flow-through method was in the public interest, and that the use of the year-end rate base was proper in that it tended to offset the rate of attrition. This also enabled the company to have a level of earnings adequate for the foreseeable future.

While the PUC did not allow cash working capital in the determination of its net investment rate base, it did include, in addition to construction work in progress, materials and supplies.

Kin of Detroit Ed Pioneer Starts New Unit

Sarah P. Andreae, grand-daughter of the late George Peck, who was president of a Detroit Edison Co predecessor—Edison Illuminating Co—opened the throttle of a new 320-Mw turbine generator at brief St. Clair Power Plant ceremonies last month. Mrs. Andreae is the wife of Richard C. Andreae, a director of the company. Lending a helping hand, above, is George F. Campau, plant superintendent. The St. Clair plant now has five units on the line with a total capacity of 980 Mw. A sixth unit, scheduled for completion in April of 1961, is under construction.

Con Ed Petitions Court on FPC Gas Pact Order

Consolidated Edison Co of New York has petitioned the U. S. Third Circuit Court of Appeals to review a recent Federal Power Commission order which had denied a proposed natural gas transportation contract whereby Con Ed would have obtained 50-million cubic feet of gas daily for use at its Waterside generating station in New York City.

Con Ed, under the proposal, would have bought gas directly from producers in Texas, and Transcontinental Gas Pipe Line Corp would have transported the gas from Texas to Con Ed in New York. The power company would have used the gas to convert coal-burning boilers at its Waterside plant to gas after New York and United Nations officials had complained over heavy exhaust gases from the plant.

The FPC turned down the application on grounds it would reduce Transco's gas supply capacity and force field prices down, if other utilities followed Con Ed's plan.

Cites Threat to Private Atom-Power

Clapp of Florida Power warns Clearwater SEE meeting cost breakthrough could spur public power clique's maneuver

An early breakthrough on atomic power costs will stir up the advocates of public power, the Southeastern Electric Exchange was told at its Engineering & Operations meeting, April 16-17, at Clearwater, Fla.

To resist this invasion, utility people must be well informed and ready to act, said W. J. Clapp, Florida Power Corp president. Edwin Vennard, vice president, Edison Electric Institute, reenforced his warning by predicting that the next political threat to the electric companies would be a series of meetings, to promote such public ownership.

Home heating and cooling by electrically powered wall panels, supplementing available equipment, is the way to maintain growth rates of residential loads, said C. W. Mills, Westinghouse. Commercial loads, he said, are benefitting from higher-level store lighting, and the prospect is bright for new schools and churches.

Cites 1968 Kwhr Goal

Industrial loads, said Mills, can reach 557 billion kwhr in 1968 if the industry applies itself to the job.

Automatic operation of steam electric plants will be common in the next decade, predicted F. A. Ritchings, Ebasco Services, Inc., and will include automatic startup, hot or cold, after initiation by the plant staff, operation at optimum efficiency, and controlled shutdown. The initial installation slated for Louisana P&L Co's Little Gypsy Station in 1962 will be an expansion of the monitor-and-results computer concept to control plant operation.

Savings through automatic scanning, data logging, and results computation appear to be enough to justify their use for 100 Mw units and larger, Ritchings said. But it is difficult to ascertain whether the savings will pay for the added investment for complete control.

Flame detection equipment aids safe, efficient operation of boilers at Baltimore G&E Co's Wagner Station, said J. U. Baley. They enable control room operators to monitor pulverized coal burners too remote for direct visual observation.

The Wagner Station system depends upon lead-sulphide cells at key positions in each flame, said Baley. Compressed air puffs cut fly-ash accumulations, and insulating barriers keep out excessive heat. The method was adopted after television monitoring had been found too costly.

Urges Automation

It is highly desirable to make boiler water treatment completely automatic, said W. B. Gurney, Gulf States Utilities Co. Automatic analyzers for total solids, silica, and sodium should be included, particularly for plants of over 1,800 psi, he added, because silica in the steam can soon cut turbine efficiency and capability. Boosts in maintenance costs and downtime are incurred.

Scavenging the boiler feed water with a mixed bed demineralizer and filters close to the boiler combats contamination from condenser leakage, silica pickup, and corrosion products, said V. J. Calise, Graver Water Conditioning Co. By keeping boiler tubes and turbines clean, it reduces thermal losses as well as outages for maintenance.

The once-through boiler is safer and simpler to operate, requires less maintenance, and gives greater availability and operating economy for less plant investment, said E. G. Kispert, Babcock & Wilcox. Eliminating the conventional steam drum does away with associated operating problems and simplifies erection. Its constant steam temperature saves fuel and avoids thermal shocks.

W. J. CLAPP, Florida Power Corp president, urges industry to atom action

An homogeneous reactor with mixed fuel and graphite moderator gives an enormous gain in heat transfer, said Dr. Peter Fortescue, General Atomics. When enriched fuel replaces natural uranium and there is intimate contact between fuel and moderator, the reactor requires only 1/16 of Calder Hall's pressure-vessel volume. Boosting steam to 1,000F brings additional gains, he said.

Proposals for the high-temperature, gas-cooled, graphite-moderated reactor call for completion of a 40-Mw plant by 1963. Its second core, canned in graphite instead of metal, is expected to heat its helium coolant to 1,382F and produce 1,450-psig steam at 1,000F. Experience with this HTGR prototype, said Fortescue, is expected to guide construction of a later 150-Mw plant at $300 per kw to produce power for 8.5 to 9 mills per kwhr.

Gives R/W Economics

How wide should transmission rights of way be? The most economical for Georgia Power Co, said T. J. Allen, are 130 ft for 230 kv, 111 ft for 110 kv, and 102 ft for 44 kv. These give the lowest total cost for original acquisition, brush control, and periodic removal of dangerous trees.

Brush control by helicopter spraying costs $133 per mile for a 100-ft strip even in swampy and mountainous terrain. Control by mechanical cutting averages $156 per mile; hand cutting $211.

Concrete cast with transit-mixed concrete in machine-bored holes makes less costly transmission structure foundations than steel grillages, said J. D. Shaw, Virginia Electric & Power Co. He reported on a recent 110-kv, double-circuit, steel-tower line which has tangent structure foundations which averaged

(*Continued on page* 93)

Carrier Operates on Insulated

Louisiana Power & Light is coupling power-line carrier to insulated shield wires at 115-kv; proves economical, versatile

HAROLD L. DELONEY, Assistant Chief Engineer,
JACK DAVEY, Engineer, Louisiana Power & Light Co,
New Orleans, La.

A power-line carrier system, operating over an insulated shield wire of a 115-kv H-frame line, has been used by Louisiana Power & Light Co for the past three years for supervisory control of substations.

This system provides an economical installation when the shield wire is insulated during initial construction or in combination with another job. Maximum economy is achieved when stations are close together. Its path has lower attenuation than the conventional one when shield wires have a reasonably low conductivity. Yet it has as severe attenuation variations under different switching conditions as the untapped conventional system. Nor does it adversely change the lightning performance of the line. For these reasons the company plans to expand it wherever practicable.

The scheme was developed for supervisory control of substations as part of the company's 13-year-old program to put remote control into 65 115-kv stations. Communication of supervisory intelligence has been by telephone cable, microwave, power-line carrier, and a combination of these. Being the most economical in most cases, power-line carrier has been used with a multi-station supervisory system to conserve spectrum and reduce costs.

Conventionally, the carrier path is provided by coupling the carrier signal to the transmission phase conductors and decoupling it at the controlled substation. To be certain that the carrier signal gets to the farthest substations, even when switches and circuit breakers are open, decoupling and recoupling equipment is added to bypass each intermediate substation.

The coupling equipment is expensive, inefficient, complex. It could be eliminated, the company reasoned, were an unswitched insulated wire available to each station to transport the carrier signal. Such a wire was obtained by insulating one transmission shield wire provided to improve lightning performance.

Before installing an insulated shield-wire system, tests were performed on 115-kv lines to gauge the attenuation of shield wires under normal conditions and the variation of attenuation when parallel wires are grounded or opened. Tests were made on ½-in. steel wire (Minden-Sailes test) and on 3-strand No. 5 EMS copper-clad wire (Raceland-Houma test).

The Minden-Sailes tests were on a 21.4-mile standard H-frame, unshielded, 115-kv line before the existing ½-in. steel phase conductors were replaced by 336.4-MCM ACSR. Using the connections in Fig 1, several tests studied the effects of coupling to parallel insulated wires. It was assumed that the transmitter

Table I—Minden-Sailes Attenuation Tests

(21.4 Miles, ½-In. Steel, 115 Kv H-Frame, 14-Ft Horizontal Spacing)

Test	Frequency Kc	Overall Attenuation Db	Loss In Sailes Coupling, Db	Loss In Line Db	Loss Per Mile Db
Transmitter, receiver on middle phase, other two phases ungrounded					
No. 1	50	22.2	0.4	21.4	1.0
	60	19.6	0.2	19.2	0.9
	70	21.1	0.3	20.5	0.96
	80	21.2	0.3	20.6	0.96
	90	20.6	0.2	20.2	0.95
Noise =	100	20.5	0.4	19.7	0.92
0.06 v	110	20.2	0.4	19.4	0.91
across	120	20.9	0.4	20.1	0.94
60 ohm	130	21.8	0.4	21.0	0.98
	140	22.4	0.3	21.8	1.02
	150	23.1	0.5	22.1	1.03
				Avg	0.96
Transmitter, receiver on middle phase, Sailes end of other phases grounded					
No. 2	50	18.3	0.3	17.7	0.83
Noise =	90	19.1	0.3	13.5	0.87
0.04 v	120	19.1	0.4	18.3	0.86
across 60 ohm	150	21.1	0.4	20.3	0.95
				Avg	0.88
Transmitter, receiver on middle phase, Minden end of other phases grounded					
No. 3	50	19.6	0.2	19.2	0.90
Noise =	90	19.7	0.3	19.1	0.89
0.04 v	120	19.8	0.6	18.6	0.87
across 60 ohm	150	20.9	0.5	19.9	0.93
				Avg	0.90
Transmitter, receiver on middle phase, both ends of outside phases grounded					
No. 4	50	16.6	0.2	16.2	0.76
Noise =	90	18.1	0.1	17.9	0.84
0.038 v	120	17.9	0.3	17.3	0.81
across 60 ohm	150	19.5	0.5	18.5	0.86
				Avg	0.82
Transmitter on middle phase, received signal on other phases, middle phase terminated in 470 ohm					
No. 5	50	20.9	0.2	20.5	0.96
	90	26.0	0.2	25.6	1.20
Left Phase	120	25.4	0.3	24.8	1.16
	150	26.8	0.3	26.2	1.22
				Avg	1.14
	50	21.2	0.1	21.0	0.98
	90	27.2	0.1	27.0	1.26
Right Phase	120	27.1	0.2	26.7	1.25
	150	27.7	0.2	27.3	1.28
				Avg	1.19
Transmitter, receiver on middle phase, middle phase grounded 4.5 miles from Minden 3.04 from Sailes					
No. 6	50	29.2	0.2	28.8	1.35
Noise =	90	36.7	0.2	36.3	1.70
0.1 v	120	42.1	0.3	41.5	1.94
across	130	31.4	0.3	30.8	1.44
60 ohm	150	32.2	0.3	31.6	1.48
				Avg	1.58

Note: In test (5), received voltage was reduced 16–25%, when the 470-ohm termination was removed from middle phase.

Shield Wire of H-Frame Line

current and voltage were in phase, and that transmitter power could be found by multiplying the two. A third assumption was that losses in the transmitter coupling facilities equalled those in the receiver coupling facilities. The losses were measured.

As shown in Table I, behavior of the ½-in. steel as a carrier path varied under different test conditions, these variations being explained as follows:

1. The I^2R losses in the steel must be high due to skin effect at carrier frequencies. This effect, becoming more severe as frequency is inceased, must be offset, to some extent, by the coupling of the signal to the parallel, insulated wires and the recoupling back —a factor which becomes more pronounced as frequency is increased. This could explain the almost constant attenuation from 50 to 150 kc.

2. Grounding of either or both ends of the other two wires lowered the line attenuation (tests 2, 3 and 4). This was due to the coupling and recoupling action of the other two wires. The opposite effect might have been observed for a different length of line under test.

3. Test 5 illustrated the accepted effect that on line-to-ground coupling identity of the phase originally coupled is soon lost and the fallacy of single-phase trapping to eliminate interference.

4. Test 6 emphasized the coupling and recoupling effects to parallel insulated wires. Attenuation-per-mile figures are probably not so significant as total attenuation figures, which can be compared with those in Test 1 to show that from 4 to 5 db is lost in each coupling or recoupling action. This value was verified in Test 5, especially at higher frequencies.

Though the Minden-Sailes tests established a steel-wire attenuation at a high of about 1 db per mile, results were otherwise satisfactory enough for the company to decide to insulate one 3-strand No. 5 EHS copper-clad shield wire on a 12.1-mile section of 115-kv H-frame line under construction. The other shield wire was grounded at every structure.

Attenuation tests on this insulated copper-clad shield wire used the same connections and yielded the data in Table II. Curves of attenuation per mile vs frequency for the two shield wires are in Fig 2.

The consequence of these tests was that the company insulated 80 miles of 3-strand No. 5 copper-clad wire to create a path for a supervisory and voice circuit to five stations. The insulated-shield-wire plan cost 7% more than the conventional one. If the insulated shield wire system proved satisfactory, however, appreciable economies would result as substations are added to this circuit.

In coupling the 56-kc carrier system to equipment, the most important item was the 400-amp line trap serving as drain coil to protect personnel and equipment by grounding the shield wire at 60 cps in each station. This coil prevents the buildup of hazardous voltages on the shield wire due to electrostatic induction and electromagnetic coupling, when only one end is grounded.

The drain coil must be of rugged construction for

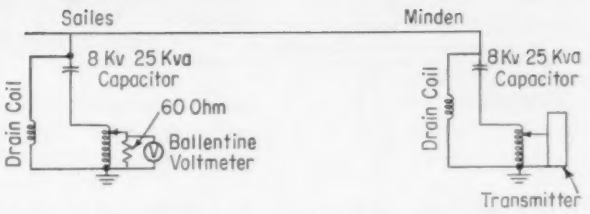


FIG 1—**CONNECTION** was used for attenuation tests. For Sailes test, location was 200 ft from termination of line

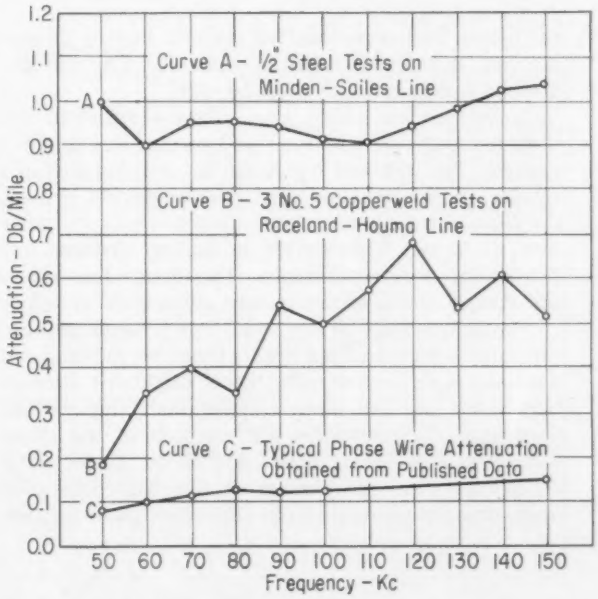


FIG 2—**ATTENUATION TEST** results are shown for the condition where the other parallel wires are left ungrounded

Table II—Raceland-Houma Attenuation Tests

Frequency Kc	Overall Attenuation Db	Losses in Houma Coupling Db	Losses Line Db	Loss Per Mile Db
50	3.1	0.4	2.3	0.19
60	4.5	0.2	4.1	0.34
70	5.4	0.3	4.8	0.40
80	4.8	0.3	4.2	0.35
90	6.9	0.2	6.5	0.54
100	6.8	0.4	6.0	0.50
110	7.8	0.4	7.0	0.58
120	9.1	0.4	8.3	0.69
130	7.2	0.4	6.5	0.54
140	8.0	0.3	7.4	0.61
150	7.4	0.5	6.4	0.53
			Avg	0.48

Shield wire	3-Strand No. 5 copper-clad wire
Line length	12.1 miles
Noise	40 db below signal

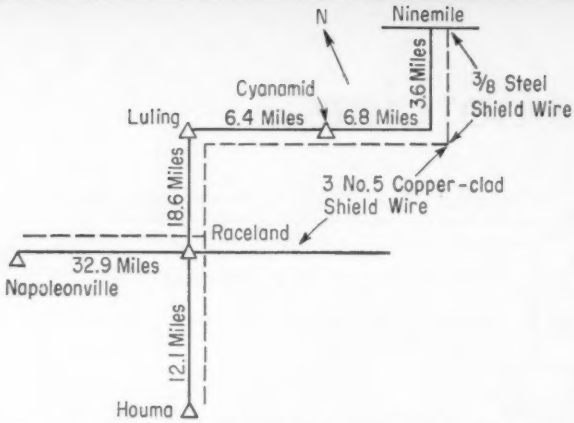


FIG 3—INITIAL INSTALLATION comprised 80 miles of shield wire between 5 substations. Carrier is 56-kc kind

the system line-to-ground fault currents flowing through it. For this reason and to limit the IX voltages, a tuned low inductance must be used.

To insulate the shield wire, a special insulator was designed with the electrical and mechanical qualities desired. The insulator was made by omitting part of a regular 10-in. insulator skirt. Although not critical, the characteristics of the insulator are: 18-kv dry flashover, 10-kv wet flashover, 1½-in. leakage distance, and 1½-in. dry arc-over distance. This design has proved satisfactory and does not require an external spill gap.

Attenuation tests on the actual installation compared favorably with calculated results based on previous test data and were considerably below calculated attenuation values for the more conventional coupling and bypassing of phase wires. Attenuation of the shield wire, all switches being closed, was 30 db. Under worse conditions, with one breaker at Raceland Substation open, attenuation was 44 db. This duplicated the predicted value and was less than the 50-db calculated attenuation with conventional coupling, illustrating the appreciable effect of paralleling insulated wires.

While improving attenuation, adoption of the scheme has not changed the lightning performance based on about 200 miles of 115-kv lines with insulated shield wires. Compared with the 1,300-kv BIL of the phase wires, the shield wire insulator has only an 18-kv impulse flashover, and its effect is decreased by the second shield wire solidly grounded at every structure.

Since proving the feasibility of this system, all new transmission line proposals are studied to determine whether their routing makes them adaptable to the insulated-shield-wire scheme. If so, a grounded shield wire of either ⅜-in. galvanized steel, or of 3-strand No. 5 copper-clad wire is installed on one side of the structure, and an insulated shield wire of 101,800 CM, 12/7 ACSR on the other side during construction. This ACSR shield wire has about half the attenuation of copper-clad wire and a quarter of that of ⅜-in. steel. Two more multi-station installations employing an insulated shield wire will be completed soon.

The insulated shield wire will probably not be a good path for carrier relaying. A lightning stroke on one transmission line a multi-line substation could raise the ground potential enough for it to flash over the shield-wire insulators on other lines terminating in the station. These other shield wires could become part of the 60-cps fault-current ground return path, and, as such, the arc would be maintained across the shield-wire insulators for the duration of a 60-cps fault.

Grounded shield wires on unfaulted lines would prevent the transmission of the carrier blocking signals because the carrier transmitters would be shorted practically at their terminals. Without receiving blocking signals, the remote unfaulted line terminals would, of course, trip falsely. Even though the shield wire on the faulted line is shorted, it will relay correctly.

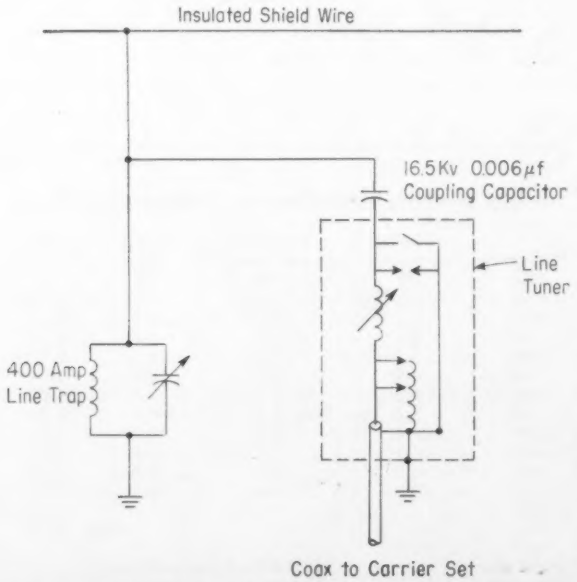
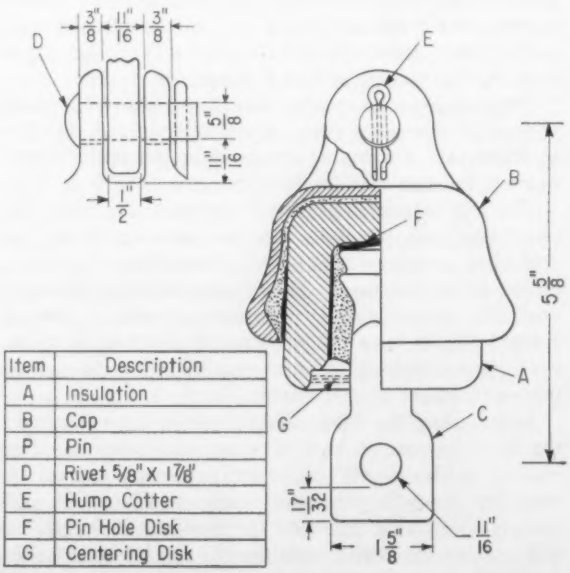


FIG 4—COUPLING SCHEME has 400-amp line trap to ground insulated shield wire at every substation for safety



Item	Description
A	Insulation
B	Cap
P	Pin
D	Rivet 5/8" X 1 7/8"
E	Hump Cotter
F	Pin Hole Disk
G	Centering Disk

FIG 5—INSULATOR with 18-kv dry flashover has proved to be satisfactory and does not require external spill gap

Measures Temperature Loads

Arizona PS gauges usage, demand, coincident factor as impact of air conditioner and heat pump affects the system

R. E. REINHOLD, Supervisor, Electrical Engineering, Arizona Public Service Co, Phoenix, Ariz.

As all-electric homes increase, each utility company faces the problem of serving high residential load densities. Studies by Arizona Public Service Co give an insight into what can be expected.

Each utility must study its own system conditions, as the group characteristics of air conditioners or heat pumps may vary widely. These studies should underline the changes in load pattern, load factor and diversity, and the increase in kwhr usage brought about by air conditioners and heat pumps.

Effects Now Sufficient

Wherever a load-building device for adding about 7,500 kwhr annually per residence at only 12% annual load factor appears, utility engineers are challenged. Loads, such as refrigerated air conditioners and heat pumps, are growing rapidly and their effect on utilities is considerable. Arizona Public Service was among the first to deal with this type of load, one that passed through the low-diversity evaporative cooler phase to today's burgeoning refrigerated air conditioning and heat pump saturations. These saturations are now enough to allow a study that can pinpoint the effects on the power system.

Probably the most important characteristic of air conditioners affecting utilities is the low annual load factor and load peaking effect. These are significant from individual and group standpoints.

Load factor varies greatly with climate. In the Phoenix area, with high temperatures over a long summer, annual load factor is relatively high. Cooling season monthly non-coincident load factor for refrigeration units is 36 and 30% for 3 and 5-hp units, respectively. This happens because the larger units are somewhat oversized and have longer off portions in the operation cycle.

The annual non-coincident load factors for equivalent-hp refrigeration units and heat pumps (cooling cycle) are very close, about 12%. Though this may seem low, other areas have lower ones.

Data for the typical average coincident demand curve, Fig 1, were obtained during a 14-day field test on 28 refrigerated air conditioning units in the summer of 1955. Average non-coincident demand was 5.5 kw, giving a 66.5% coincidence factor on the 3.65-kw coincident demand.

These curves were about the same for weekdays as for weekends. Base load, without electric range, dryer, or other major appliance, is small compared to air-conditioning load. The latter load peak is ahead in time of the base peak, so that range usage would make the base and air-condition peaks coincide. Ratio of peak air conditioning load to base load at 6 PM is 5.3.

As heat pumps are being added faster each year, a characteristics study was started in 1956. Field tests were made over a year on 28 homes, having eight 3-hp, ten 5-hp, eight 5-ton (6½ hp) and two dual-unit (a 3 and a 5-ton unit) installations.

Recording demand meters charted three-week tests at summer and winter system peaks. Kwhr meters were read monthly. The heat pump table shows the computed results.

Average non-coincident demand

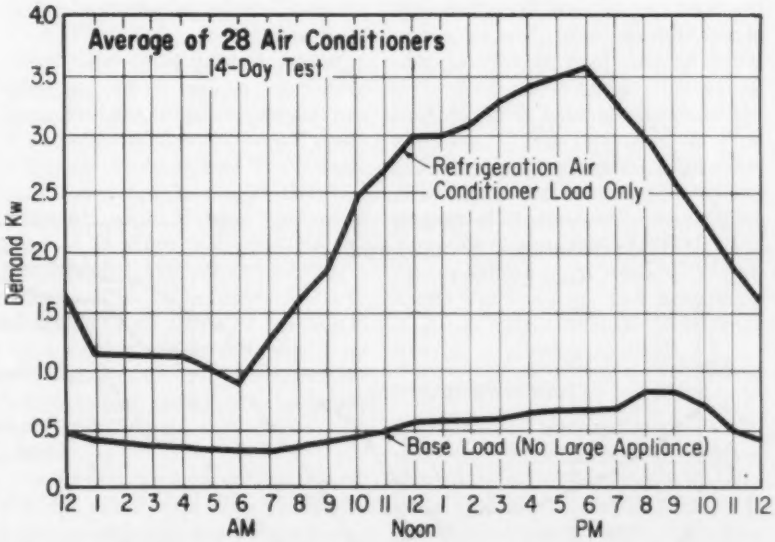


FIG 1—COINCIDENT DEMAND CURVE for average of 28 units on summer day

Average Heat Pump Test Results

28 Units, Summer 1957—Winter 1957

	Cooling Season	Heating Season	Annual
Non-coincident demand, kw per unit	6.92	7.78	7.78
Coincident demand, kw per unit	4.42	3.37	4.42
Coincidence factor %	64.0	43.4	55.8
Kwhr per unit (average of all units)	7,244	3,870	11,114
Annual load factors			
Non-concident %	12.1	5.74	16.5
Coincident %	18.9	13.3	28.7
Time of peak	3:30 PM	7:15 AM	

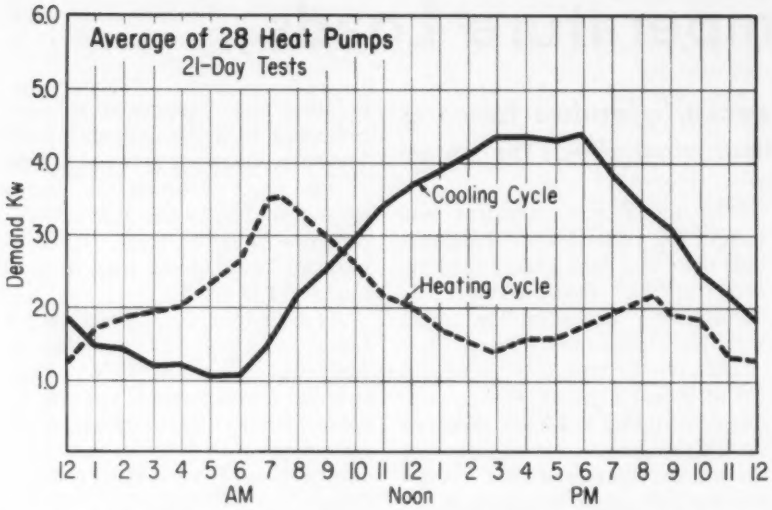


FIG 2—**COINCIDENT DEMANDS** for heat pumps during season's load peaks

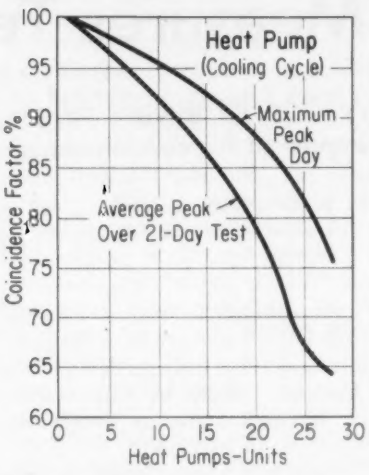


FIG 3—**CURVE** predicts diversity for fewer units, for design and loading

of a heat pump was 7.78 kw in winter and 6.92 kw in summer, the difference due to resistance heaters operating in seven of the 28 units. In other areas, auxiliary heating elements may be used in all units, affecting the load factor accordingly.

Coincident demand is lower during the heating season, which would be expected in areas of high summer-temperature and mild winter. St. Louis area tests show the opposite—7.98 kw in winter and 6.85 in summer.

Winter heating kwhr was 34.8% of the total against 65.2% for summer cooling. But the kw demand is nearly balanced. Again the St. Louis tests show the opposite, heating kwhr 68% vs cooling 32%.

Arizona PS found the cooling coincident annual load factor higher than the heating. Total cooling and heating annual coincident load factor was 28.7%, compared with St. Louis's 30.0%.

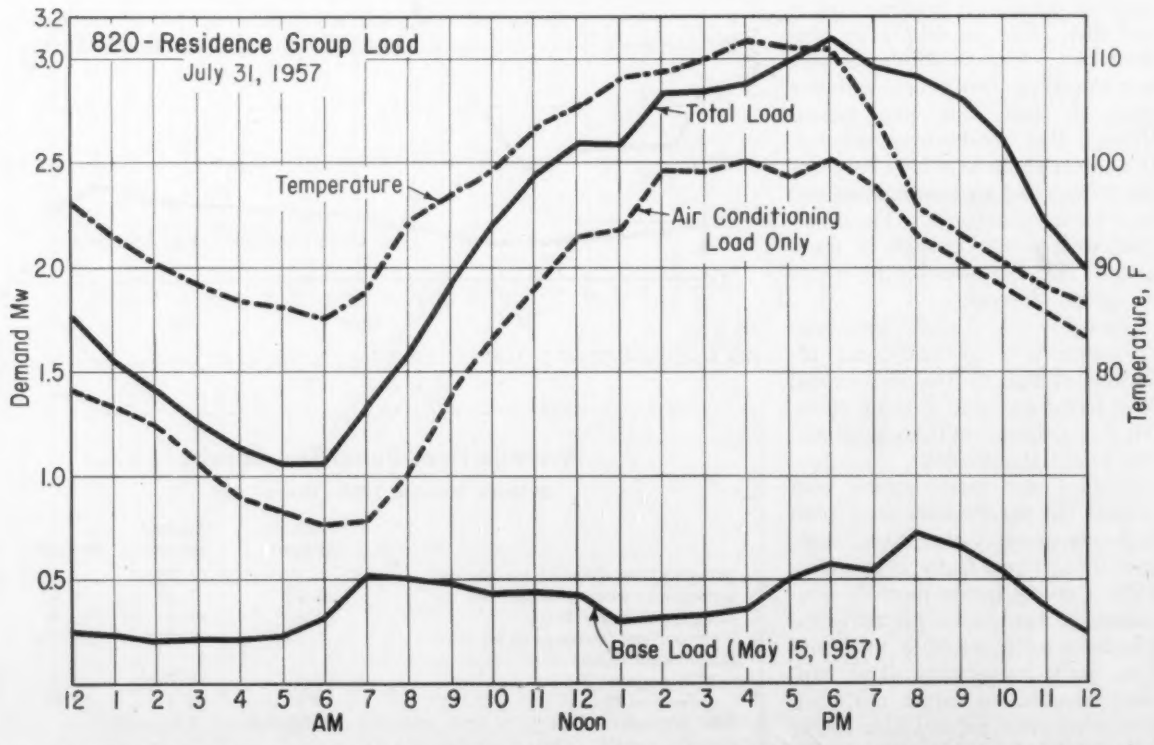


FIG 4—**AIR CONDITIONING LOAD** of group includes 298 refrigeration and 322 evaporative units for 820 homes

Fig 2 illustrates the cooling and heating cycle average coincident demand curves for the 28 heat pumps. Heating peak occurs before 8 AM, fortunately not coinciding with the daily system peak which is in the evening. But the cooling cycle provides less diversity, reinforcing the daily peaks when the ambient temperatures are highest. Thus Phoenix transformers can't be loaded as heavily.

The coincidence factor, a measure of diversity among units, is higher in summer than winter, 64% against winter heating's 43.4% for the 28 units.

For secondary design and distribution transformer loading, it is important to know what diversity can be expected among fewer units. Using the test data, a coincidence factor curve from one to 28 units was drawn for average peak and maximum peak loading (Fig 3). With little diversity among the units normally connected to one transformer-secondary combination, the noncoincident load should be used.

Cooling season coincidence factor for only nine units is 92.8% on the average peak curve, compared to 92.2% for nine St. Louis units. This is as was expected.

Tests in 1957 on about half a Phoenix residential feeder area gauged the effect of air conditioning on the distribution system. Demand metering was installed in the primary of a relatively new residential area about 75% developed, having this connected-load spread:

Type	No.	% of Total
Total homes	820	100.0
Evaporative coolers	322	39.5
Refrigeration Units:		
3-hp	113	13.7
5-hp	328	40.0
7½-hp	51	6.2
10-hp	5	0.6
15-hp	1	—
Total refrigeration units	498	60.5

Branch feeder demand meters provided typical daily load curves for the total load at different times of the year. A load curve plotted May 15, when there is no heating or cooling load, gives the base load.

Subtracting this from the summer peak load curve of July 31 gives the air conditioning load (Fig 4). This is the combination of refrigeration units in 498 homes and evaporative cooling in 322. Arizona PS knows that evaporative coolers are started at 80 to 85F and operated through the day with virtually no diversity.

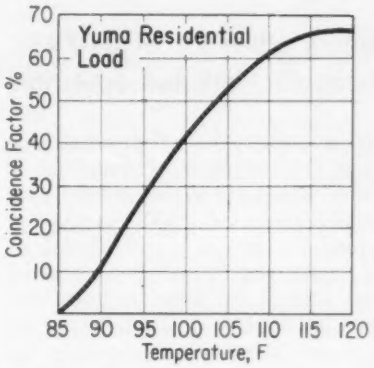


FIG 5—YUMA'S 55% air conditioner saturation produces such a pattern

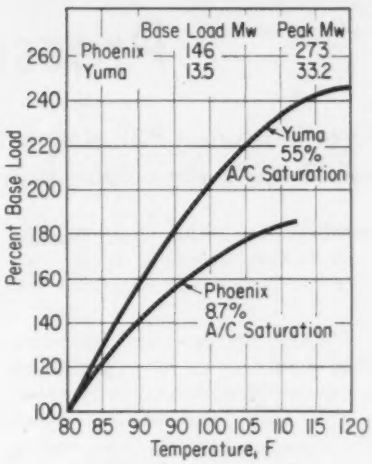


FIG 6—URBAN LOAD CURVES respond to a high cooler saturation

The daily peak, like the average individual daily load, is at 6 PM. Thus, the air conditioning peaking effect predominates and would coincide with the base load peak, were there many electric ranges. Ratio of air-conditioning to base load at 6 PM is 4.2, which is lower than the 28-unit air-conditioning load test finding. This is because the area test's base load included all appliances and its air-conditioning load many 1/3 or ½-hp evaporative coolers, which reduced the peak kw below that of the all-refrigeration peak.

A further analysis of air conditioning effect on systems results from examining load-temperature relations. Studies were made for Phoenix, with an air-conditioning saturation of 7.8%, and Yuma with 55.0%. From the latter residential air-conditioning load, a temperature coincidence factor curve (Fig 5) was drawn, illustrating how the factor increases rapidly with outside temperature.

Significantly, the curve flattens at 66%, consistent with the maximum peak day coincidence factor curve in Fig 3. The latter shows 77.8% for 28 units but flattens as the average peak curve does. Apparently there is no complete loss of diversity such as occurs with room-type coolers during "heat storms." Thus a 66% coincidence factor may be used in primary system and substation design.

Temperature effect on the system load is illustrated by Fig 6. Its two curves show the percentage of the 80F base load for higher temperatures. This base was used as probably little residential air-conditioning would be operating. Comparison of Phoenix with Yuma load at 112F shows the effect of high air-conditioning saturation. The Yuma curve shows that maximum load and maximum coincidence factors are reached near 120F.

Project Densities

Analysis of air-conditioning loads and coincidence factors can be used to project future load densities. Average Phoenix residential lots are a commercial quarter-acre, and there are about 2,500 lots per sq mile. Area load density will be 11,250 kw per sq mile at 100% refrigeration saturation plus other normal residential load. Superimposing an electric range saturation of 28%, load density will be 13,000 kw per sq mile. A 50% air-conditioning saturation will give a load density of 8,300 kw per sq mile.

These densities far exceed those of most utilities' residential areas now. Phoenix's and Yuma's 8,000 kw per sq mile is becoming common and, before long, the higher density will be reached in new areas.

Pressure-Fired Cyclone Furnaces

Give Wisconsin P&L station thermal efficiency of 34.74%, 9,823 Btu/kwhr output; prove popular with the operators

LESLIE W. HOFFMAN, Plant Manager, Rock River Generating Station, Wisconsin Power & Light Co, Beloit, Wis.

Cyclone burners and pressure-fired boiler units have performed satisfactorily at Wisconsin Power & Light Co's five-year-old Rock River Station. In 1957, the station operated at a thermal efficiency of 34.74% and averaged 9,823 Btu per kwhr of net output.

The cyclone is a water-cooled horizontal cylinder into which crushed coal is fired. The fuel is introduced tangentially into the burner at the cyclone's front end. Heat is released at about a half million Btu per cu ft. Combustion is 98% completed in the cyclone. Gas temperatures of 3,200F in the cyclone are enough to melt the ash to a liquid slag which flows toward the rear of the firing unit for discharge through a tap hole to the primary furnace. It then goes to the slag tanks. As there are no precipitators, 85% of the fly ash goes out as slag.

With pressure firing, air for combustion is delivered to the cyclone at 50-in. water pressure after passing through the air heater. Forced-draft fan pressure forces the gases from the cyclone through the boiler furnace and air heaters to the stack. The whole unit is under pressure. The boilers were designed for an output of 525,000 lb of steam per hr at a superheater outlet pressure of 1,500 psig. Initial steam temperature is 1,005 F with 1,005F reheat. There are three 8-ft cyclones for each of the two boilers, and each boiler supplies steam to a 75,000-kw unit.

In starting the first unit, regular procedures were followed. Induced draft fans were put into service, and negative furnace pressures maintained for the first month. After the shakedown had familiarized operators with the equipment, pressure firing was started. Within a few days, operators preferred the pressure type firing to the negative-furnace-pressure operation. Accordingly, they started the second boiler on positive pressure.

ID fans are operated now for a few minutes weekly during checks on their condition or when casing leaks develop. The latter are repaired with normal load on the boiler unit.

When the first boiler had operated 36,450 hr and the second for 29,100 hr, average boiler efficiency was 91% at a leaving gas temperature of 250F. The cyclones operated satisfactorily, with a minimum of unburned-combustible loss, at 12% excess air. Gas recirculation equipment has a dual use. First, it increases mass flow of gas during low-load to assist in maintaining superheat and reheat temperatures, introduced into the furnace at "A" in Fig 1. It also reduces slagging on superheater tubes when introduced at "B" in Fig 1. The flow of recirculating gas is controlled by manually operated dampers.

Steam temperatures are controlled automatically by dampers in the furnace and spray attemporators. Gas flow is increased or decreased through the superheater or reheater tube sections by steam temperatures. Final steam temperatures are controlled by spray attemporation.

Coal as received varies from lump to carbon. The amount and the fusion and fluid temperatures of the ash vary over a wide range, as do

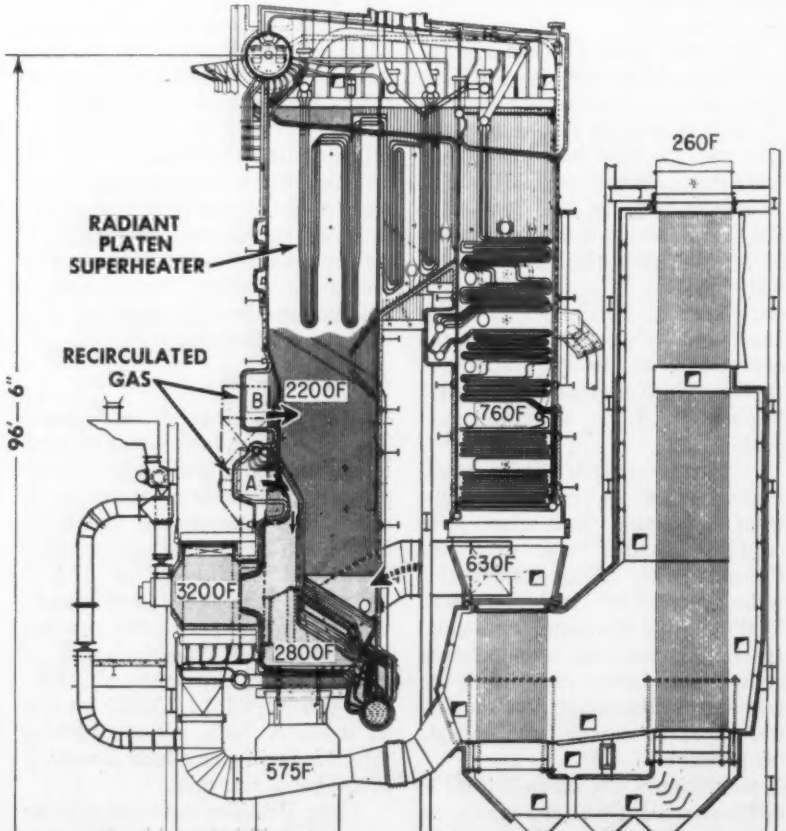


FIG 1—**RECIRCULATING GAS** helps maintain superheat and reheat temperatures and reduces slagging on superheat tubes. 85% of fly ash converts to slag

Work Well

also the moisture and heating values of the coals. No coal used has had a limiting effect on the capacity of the plant, nor has it presented any abnormal operating problem. But some difficulties were encountered with slag flow when the coal burnt had an ash-fluid temperature of 2,700F or higher. These occurred at loads of about 25% of boiler capacity, when a single cyclone had been in use for several hours. Heat in the primary furnace was not enough to keep in a molten state the slag which continued to drain from the operating cyclone into the primary furnace, and it could not continue flowing out of the two openings in the primary furnace floor to the slag tanks. Surplus slag in the primary furnace was removed by increasing the boiler load to about 40% for a short time.

Station auxiliary power requirements amount to 6½% of the gross generation when average capacity factor is 70%. At 100% capacity factor, these requirements are well below 6%. FD fans use 37.16%, and boiler feed pumps 29.36% of the total requirement.

Soot blowing is done with 300-psig air and automatic sequential type equipment. Boiler furnace blowers are operated weekly, and all other blowers—those in the superheater, reheater, economizer, and airheater sections—twice daily. Neither boiler has needed hand lancing. At the last inspection the fire sides of the superheater and reheater elements showed negligible deposits, and there was no indication of fly-ash erosion on any surface. Boilers operate at 115% of rating during peak-load periods.

On three occasions Unit 1 showed an increased gas-pressure drop across the airheater, accompanied by a rise in exit gas temperature. This indicated a fouling of tubes in the cold section of the airheater.

The boilers have split airheaters, so that half of them can be isolated for washing while the boiler is in service. When the gas-pressure drop was increasing, the airheater was washed while the boiler unit operated at half capacity without difficulty. Washing took about 10 hr and

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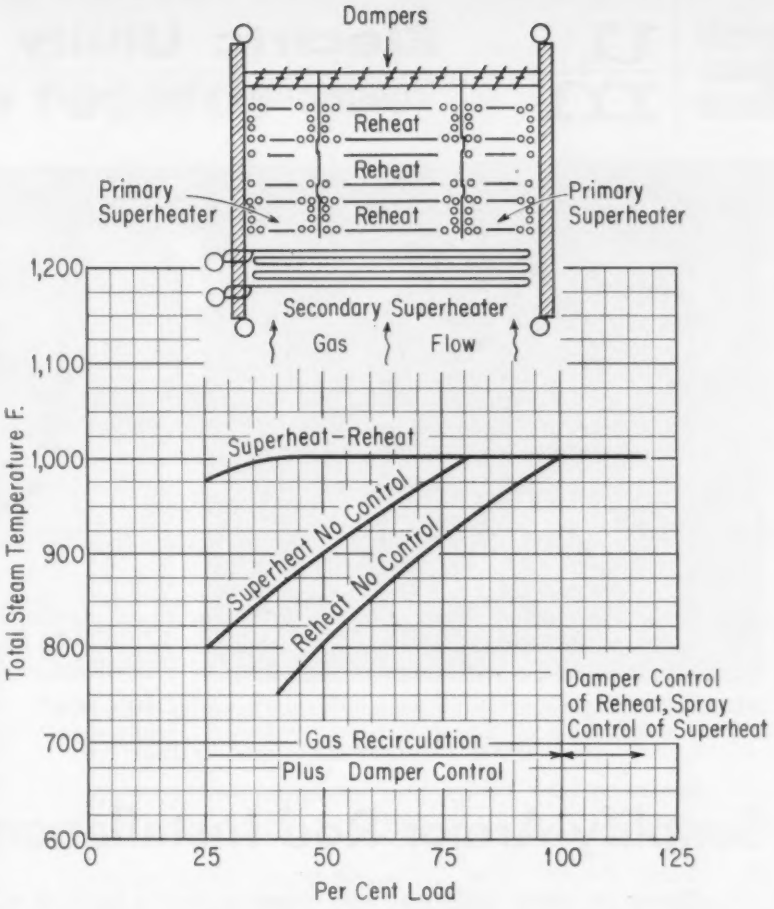


FIG 2—STEAM TEMPERATURES are controlled automatically by dampers in the furnace and by spray attemporators; recirculating gas has manual control

Table I—Furnace Gas Temp., F

Cyclone, Approx	3,200
Primary furnace	2,800
Secondary furnace	2,200
Superheater, Reheater Section Outlet	760
Gas temp leaving station	260
Combustion air temp leaving air heaters	575
Re-circulating gas temp	630

Table II—Analysis of Coal, as Received

	Coal No. 1	Coal No. 2
Moisture	7.46	15.92
Ash	5.99	8.52
Sulphur	3.40	2.95
Volatile	38.75	32.66
Fixed Carbon	48.70	42.90
BTU	12,593	10,770
Ash Softening Temp	2,360	2,180

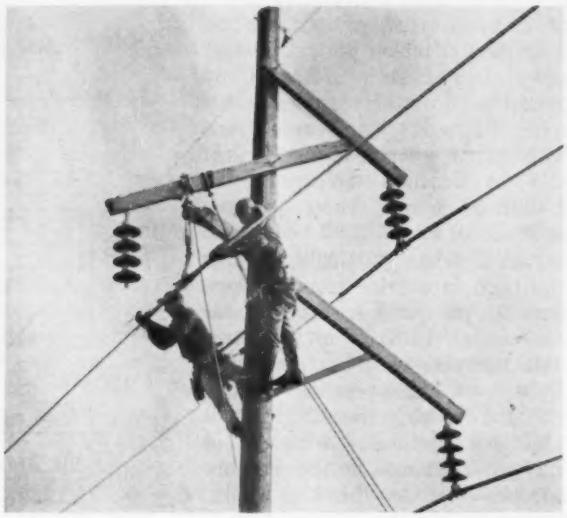
Table III—Station Auxiliary Power Requirements

	Auxiliary Power %	Gross Generation %
FD Fans	37.16	2.420
BF Pumps	29.36	1.910
Circulating Water Pumps	11.26	0.732
Soot Blowing	5.25	0.341
Service Water	3.03	0.197
Coal Handling, Conditioning	1.30	0.084
Gas Re-circulating Fans	1.16	0.075
Plant Lighting	1.79	0.116
Miscellaneous	9.69	0.630
Total	100.00	6.50

Table IV—Maintenance Cost of Coal Handling per Ton Burned

Conditioners	$.021
Crushers	.002
Conveyors, Chutes, Etc.	.001
Locomotive	.002
Crane, Etc.	.010
Total Maintenance Cost	$.036

STEEL HOOK for holding conductor during armor rod installation is drilled at the top for bolt and clevis attachment



CHAIN HOIST holds tool and conductor at a convenient height while rods are installed. Hoist hangs on crossarm

Simplify Armor Rod Installation

Installation of armor rods on large (954 MCM) ACSR has been eased for Kansas Gas & Electric Co crews through the development of a tool for holding the conductor. The tool consists of a piece of flat steel shaped to form a hook. It is drilled at the top for a bolt, which holds a clevis.

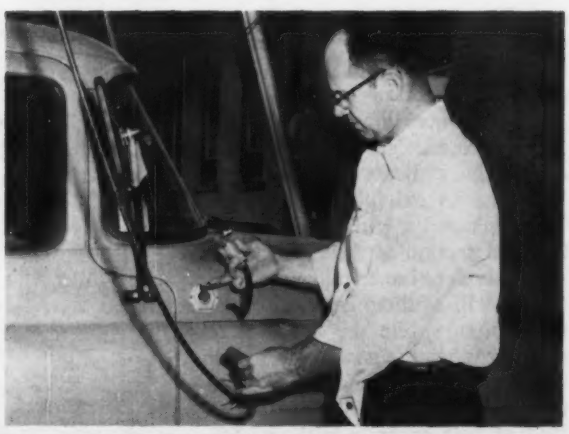
A chain hoist is secured to the crossarm and the tool is suspended from it. The hoist is adjusted to hold the tool at a convenient height. The conductor is rested in the hook while armor rods are installed. Installing rods in this manner is less tiring for the men and the job can be done more quickly.

Charge Vehicle Batteries Easily

Charging batteries of the automobile and truck fleet of San Antonio Public Service Board has been reduced to a minimum effort by bringing connections from the battery charger to cords suspended near the parking space for each vehicle. Connections from the battery of each vehicle have been brought to a point accessible by lifting a flap similar to those that cover the access to the gas tank.

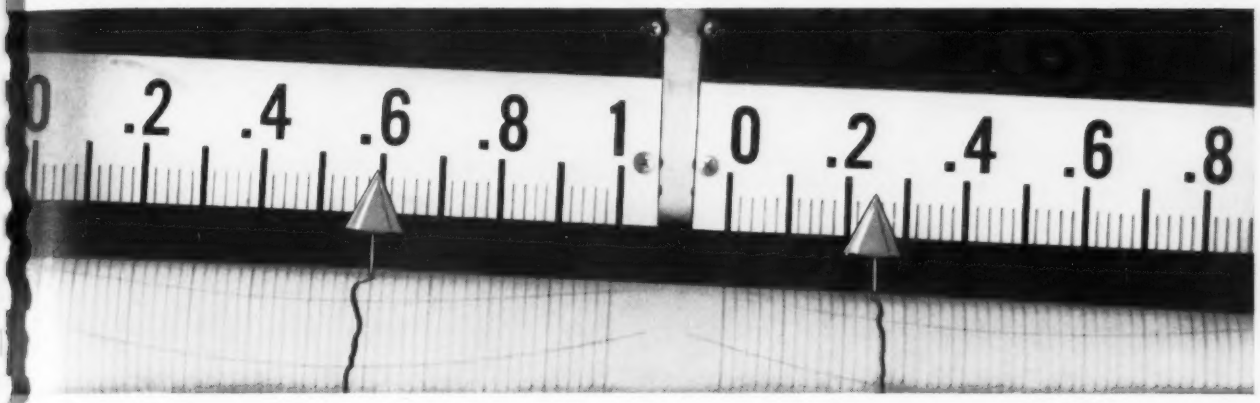
Car ignition is interlocked with the receptacle on the vehicle that takes the cord from the battery charger. The engine can't be started while the battery charger is plugged in. The interlock arrangement has eliminated damage to cords resulting from driving the vehicle away while the battery charger was still plugged in.

Two battery charger connections have been provided, one connection for 6-v and one for 12-v vehicle batteries.



BATTERIES ARE CHARGED by plugging in cord near each vehicle stall. Engine can't start while cord is connected

plots twin records . . .



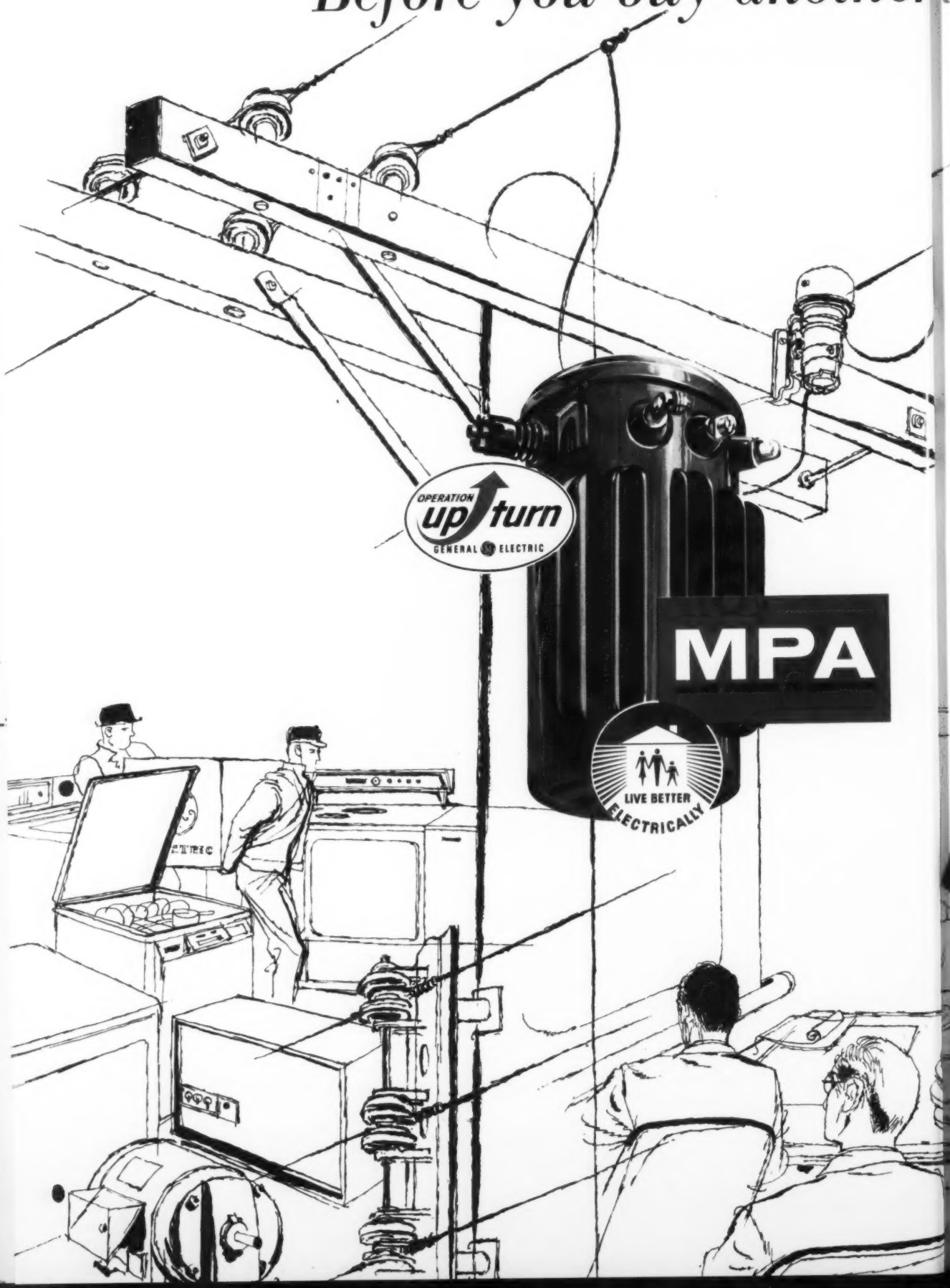
This new General Electric Type CH-37 duplex recorder plots two complete electrical records side by side on one ten-inch-wide chart. No more reading separate charts . . . now related functions such as watts and vars, volts and frequency, d-c amperes and speed can be measured and recorded with 1% accuracy on ***one strip chart.*** The CH-37 saves valuable panel space . . . it's only 15 inches wide by $16\frac{1}{16}$ inches high and semi-flush mounted. It features ***throw-away inkwell,*** multiple chart speeds, chart supply indicator, fluorescent-lighted chart face and gasket-sealed door with key lock. Companion models include a new narrow-range CH frequency recorder, self-contained and with accuracy of ±.05 cycles and range of only 58–62 cycles . . . and the CH-7 hook-on volt-ammeter, for accurate recording of dip and peaks on exacting maintenance jobs. Get the complete story on General Electric's line of CH recorders. Just call your nearby G-E Apparatus Sales Engineer or write direct to Section 592-201, General Electric Company, Schenectady 5, N. Y.

OTHER INSTRUMENT DEPARTMENT PRODUCTS FOR INDUSTRY—
Switchboard and panel instruments, electric recorders and controllers, pyrometers, timing devices, speed and color measurement, laboratory test instruments.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Before you buy another t



ner transformer... **MEASURE**

LOAD BUILDING

General Electric programs and products put load on your line

For every distribution transformer you purchase from General Electric, almost a dollar is invested in More Power to America, Live Better Electrically, Operation Upturn, and in other industry-wide load-building and adequate-wiring programs.

General Electric sells two dollars' worth of equipment to *consume* electric power for every dollar's worth sold to *produce* electric power. And you get the load built by these power-consuming products, ranging from home appliances to giant furnaces for industry. So General Electric products as well as programs build load.

Before you buy another distribution transformer, measure load-building activity—give your transformer manufacturer credit for the extra values he gives you. General Electric Company, Schenectady 5, New York.

431-78

Progress Is Our Most Important Product

GENERAL ELECTRIC

GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU		G.E.	OTHER MFGRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

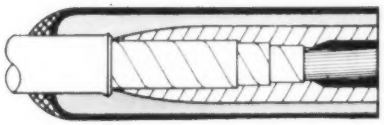
FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

THE RIGHT CABLE JOINT FOR YOU

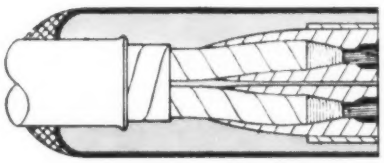
PRE-ENGINEERED

FOR LOW COST AND HIGH QUALITY

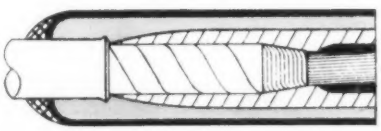
The joint design you need is most likely among the thousands of up-to-date pre-engineered designs in G&W files. They represent a thorough knowledge of the requirements of allied equipment used in power distribution.

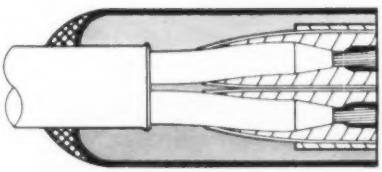


The result at G&W is a keen appreciation for the need of designing cable joints and supplying materials that are best suited to a particular type of cable.

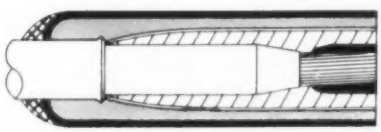


We can select the design you need in minutes. You save expensive time for engineering and ordering. G&W pre-engineering is complete to the last detail. Specifications, drawings and instructions cover the materials and the proper procedure for preparing a joint. They include each step from removing the sheath to making the splice and applying, when necessary, the protective cover or casing. This data is enclosed in the convenient unit package of materials you receive to make each joint.





Only the best quality materials are supplied by G&W. Overages are estimated to make reasonable allowances for variations of individual handling by splicers.



Do the job right the first time. Order G&W pre-engineered cable joints. Call a G&W representative for full details or write us for Bulletin JA56.

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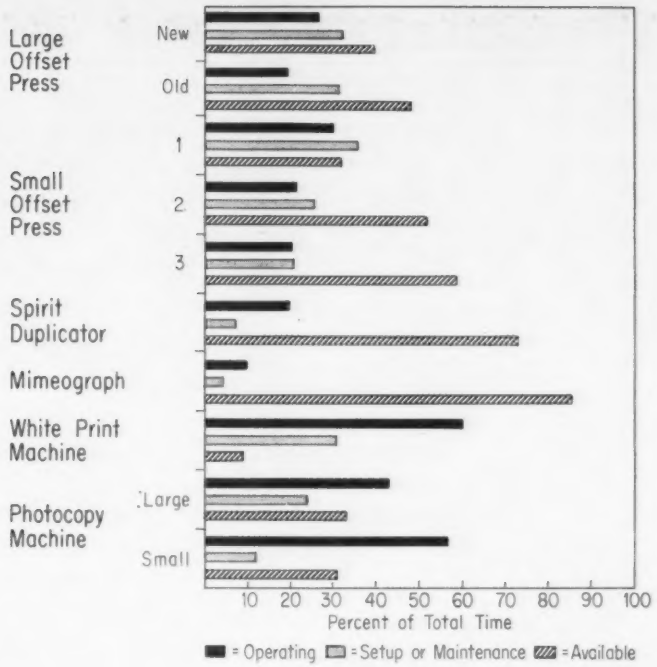
J581

Work Sampling Measures Job Efficiency

Survey of company duplicating unit shows that most machines have large amounts of idle time



ROBERT V. LONGDON, Methods Engineer, West Penn Power Co, Greensburg, Pa.

Work sampling provides West Penn Power Co with answers to problems of machine utilization, individual an crew performance, time study delay allowances and time standards for non-repetitive operations. The technique is one of the newest non-automated measurement tools available today.

Work sampling is simply a variation of the principles used in quality control. A number of random observations are taken of an individual, machine or operation by an observer who records the condition such as "working" or "idle"; "operating" or "stopped".

The ratio of working or idle observations to the total can be calculated from study results. With this ratio and the total number of observations, a degree of reliability can be placed on the results.

A study with just two elements, "working" and "idle", can find trouble points on an individual or group basis and show the need for a more detailed survey. The number of elements can be expanded to include material handling, correction of errors, waiting, personal time, telephoning, setting up, etc.

West Penn's first work sampling study was conducted in its meter laboratory and gave only the ratio between "working" and "idle" time. Results indicated there was room for improvement, which was made by setting time standards through conventional time study methods and by introducing a performance reporting system.

During a routine office work measurement survey in the company's duplicating unit, work sampling was used to determine machine utilization. This unit provides such services as black line prints, photo reproductions, typed master mats for duplication, reproductions from paper and metal master mats and many stock forms. Employees included three typists, eight machine operators and two reserve machine operators. Each major duplicating machine had an assigned operator, with reserve operators filling in on major machines and operating miscellaneous machines.

The reproduction supervisor did the observing at random times assigned by the methods engineer. This gave the supervisor added confidence in the results.

Random timetables were prepared for 25 days of sampling with eight observations daily to give the accuracy desired. Observation forms covered these phases of machine operation—operating, set-up, maintenance, available and other. Each 8½ x 11-in. form contained space for 32 observations or four days' sampling of a particular machine. Historical production records were compared with production during the sample period to verify the normality of the period.

Sampling results showed low utilization of machines; only two major machines had a use factor of over 70%.

The survey required about ½ hr each day for the reproduction supervisor and methods engineer. The engineer spent 8 hr more setting up and analyzing the study. These 33 man-hr revealed a potential saving of two employees, showed that additional equipment was unnecessary at the time, made floor space available for other purposes, and showed the supervisor better ways of utilizing equipment and personnel.

West Penn has used work sampling to determine employee effectiveness, crew performance, time study delay allowances, distribution of work loads, time standards for nonrepetitive jobs and machine utilization. The confidence and support needed were gained by keeping supervisors and employees well informed. Today, West Penn is getting answers for management with a minimum of time and expense through work sampling techniques.

Procurement & Products

PRICES ▶ **Residual oil prices are likely to remain easy** for the rest of the year despite the import restrictions. Oil industry is now suffering from an acute case of overcompensation, and the slack summer season will aggravate their woes. Importers built up a big cushion of foreign products before quotas went into effect—enough fuel oils to last out the entire summer in some locations on the eastern seaboard.

Domestic refineries also have been running at an accelerated rate, despite the warnings of oil economists. Meanwhile, the removal of import curbs from Canadian oil softens the West Coast oil picture, and similar negotiations with Venezuela are continuing.

METALS ▶ **Tendency toward hedge buying of semi-fabricated aluminum** is definitely showing up. Sheet and plate shipments rose 23½% from February (52,366 tons) to March (64,650 tons) reports Aluminum Association. Hedge buying in steel and copper began many months ago, but hasn't occurred in aluminum until past month or two. Aluminum wage contracts expire July 31. There's chance of a strike, but no certainty.

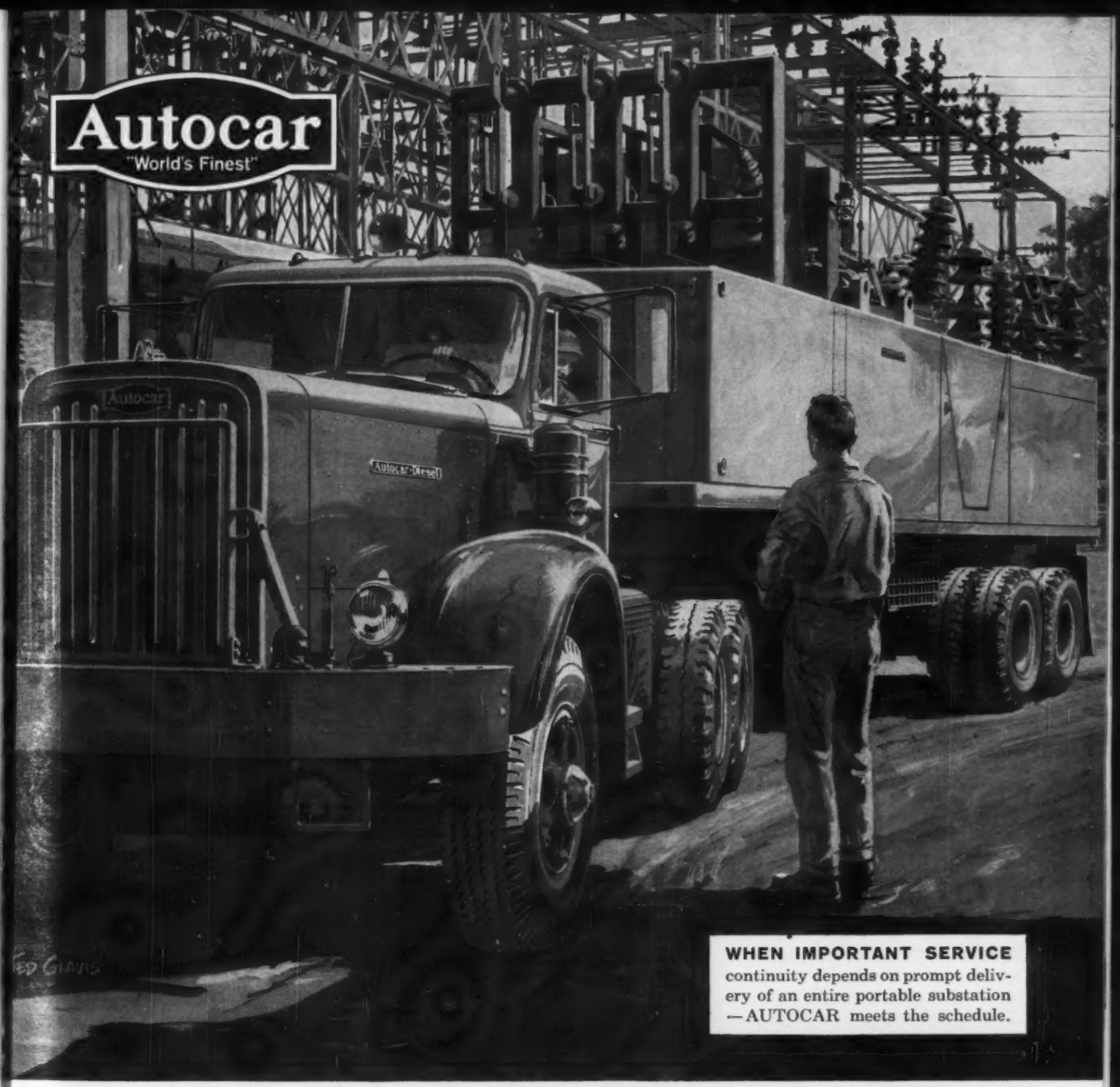
On prices, official of one major integrated producer said there is no explicit price discounting in aluminum. But freight allowance procedure does mean buyers, according to location, do not pay full quotation.

OUTLOOK ▶ **Strength of the economy is evidenced** by latest figures on car sales. Last fall, automobiles were the big "if" in many predictions of recovery. Now, with the seasonally adjusted annual rate of auto sales in the 6-million range, forecasts of a 5.5 million car year are made less cautiously. Another plus: The big three are all sure to market a small car in the fall or winter, speeding up fourth quarter auto sales and giving the entire economy a late '59 boost.

PRODUCTS ▶ **Industry will be keeping a close watch on static relays** (see page 59), because they hold promise of simplifying problems of purchasing, storing, applying, and maintaining relays and their repair parts. One manufacturer has predicted widespread use of static units for all system protective devices, but others believe these units will be for special applications "where they will do the job better and cheaper."

FLEETS ▶ **Small foreign cars for meter readers?** One utility is using them and reports mixed reaction. In densely populated urban areas, readers like the ease of handling the smaller cars, but in the rural areas readers complain the small cars lack power.

News of manufacturers . . . . . page 59
New Equipment . . . . . page 62
Readers Service . . . . . page 70



WHEN IMPORTANT SERVICE continuity depends on prompt delivery of an entire portable substation —AUTOCAR meets the schedule.

"Takes Autocar to get this load where it's needed"

A whale of a load—a whole mobile substation! One that would make an ordinary truck call it quits. But, for custom-engineered Autocars, it's all in a day's work.

Over long stretches of open road or through rugged off-highway conditions, Autocar proves every day that it can handle extra-size payloads—like giant transformers and construction equipment—with ease—and get them where they're needed, when they're needed—*fast, sure* and *economically.*

Every Autocar is custom-engineered—"tailored"—to specific operating conditions. *Every* component is designed to form an integrated, balanced unit . . . providing unequaled strength, ruggedness and staying power that make any job cost less.

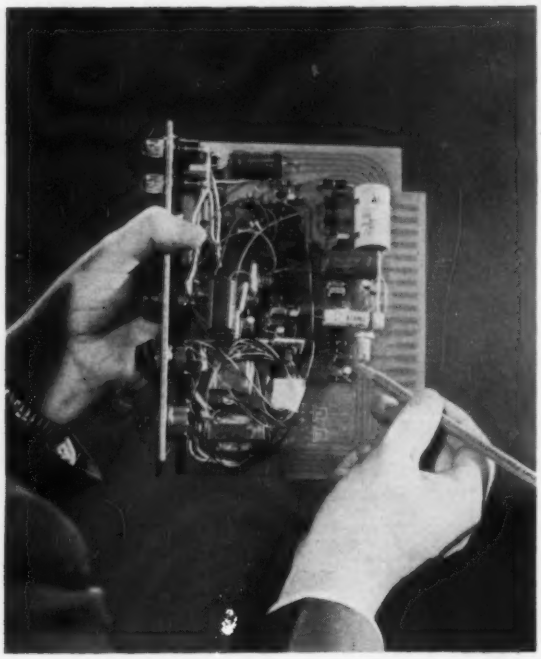
Why settle for less than the "world's finest" on *your* hauling jobs?

Autocar
"World's Finest"

Division of
The White Motor Company
Exton, Pa.

Two Companies Unveil Static Relays

Simultaneous development by Allis-Chalmers and General Electric of relays with no moving parts may open new era in protective relaying



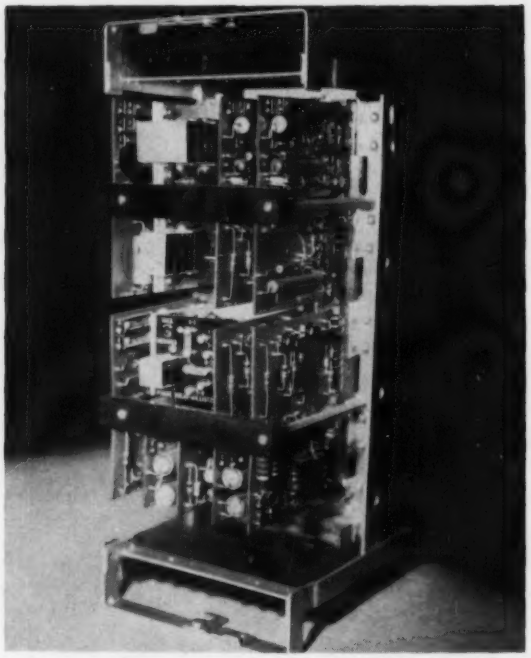
Allis-Chalmers: Overcurrent Relay

Static devices supplant all moving parts in a new electronic overcurrent relay for power system protection developed by Allis-Chalmers Mfg Co.

The design employs transistors, diodes, thermistors, varistors, capacitors, and transformers. All are mounted on a printed circuit board and potted with epoxy resin to seal against moisture and provide shock resistance. The assembly is one third the size of an equivalent conventional relay.

Dials on front of each unit facilitate setting both pickup current and time delay. Characteristics are built into the circuitry, early models duplicating characteristics of inverse and very inverse induction relays closely enough to permit immediate substitution and coordination. Switchgear Dept Manager David Webb, displaying a developmental network relay, said several voltage-restrained and watt-element relay types would soon be available and static relaying would, in the long run, permit better inverse characteristics than now available.

Limited production of the basic overcurrent relays will start this summer. Initial output will be incorporated in Allis-Chalmers switchgear.



GE: Phase-Comparison Relay

High speed is featured in a new static phase-comparison relay introduced by General Electric's Low Voltage Switchgear Dept. It is the first of a projected line of static relays for wide application in protection of high-voltage transmission lines and power system components.

Operating within 1½ cycles, says GE, the relay greatly reduces damage caused by line faults and improves stability to give better system protection. It has undergone extensive field tests on the Muskingum-Philo 138-kv line of Ohio Power.

The relay, designed for use with transistorized carrier current equipment, provides high-speed simultaneous tripping of transmission line breakers for all internal faults by comparing phase relationships of currents entering and leaving a line section.

The relay can be used on multi-terminal transmission lines. Its high sensitivity permits detection of lower magnitude faults, and heavier line loading with an equivalent protection level.

GE's relay has plug-in modular construction incorporating static components, transistors, stabistors, diodes, and reference diodes.

(More News of Manufacturers on page 60)

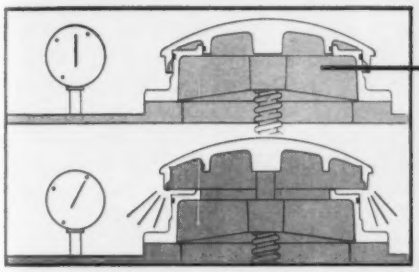
FURNACE TRANSFORMER NEWS:

The space-saving rectangular tank now standard for all Pennsylvania Furnace Transformers saves as much as 25% in overall floor space. New vaults can be smaller, less costly. Existing vaults will accommodate replacement transformers of greater capacity.

Two recently developed *time-saving* features are provided with the new space-saving rectangular tank. They are:

1 FULLY AUTOMATIC PRESSURE-RELIEF DEVICE

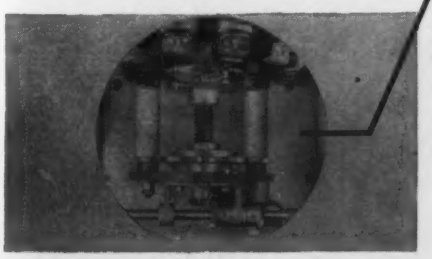
This new mechanical pressure-relief device relieves internal pressure at a predetermined setting by temporarily breaking a gasket seal around the valve cover . . . then completely and automatically reseals itself so that the device is fully effective. There are no parts to replace . . . no resetting is needed . . . *no breathing takes place* after the release of pressure. This prevents the entrance of moisture and other contaminating elements.



Top view shows pressure-relief device in sealed position. Bottom view shows how cover is raised to permit release of pressure, after which device automatically reseals itself.

2 EASY-TO-INSPECT TAP CHANGER

Pennsylvania's motor-driven tap changer is housed in separate compartments mounted on the transformer tank. This reduces down-time by greatly facilitating periodic inspection and maintenance. The mechanism includes a provision for emergency hand operation.

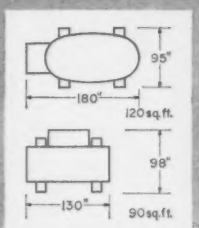


View through handhole in tap-changer compartment demonstrates ease-of-inspection feature.

Pennsylvania introduces

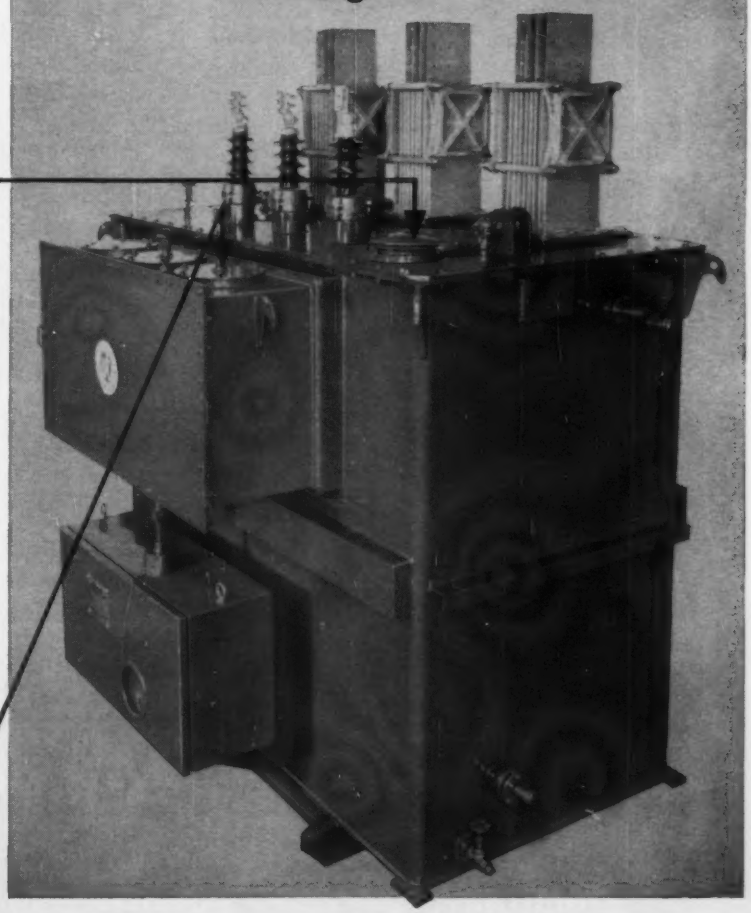
SPACE-SAVING RECTANGULAR TANK...

equipped with 2 outstanding time-saving features



25% less floor space

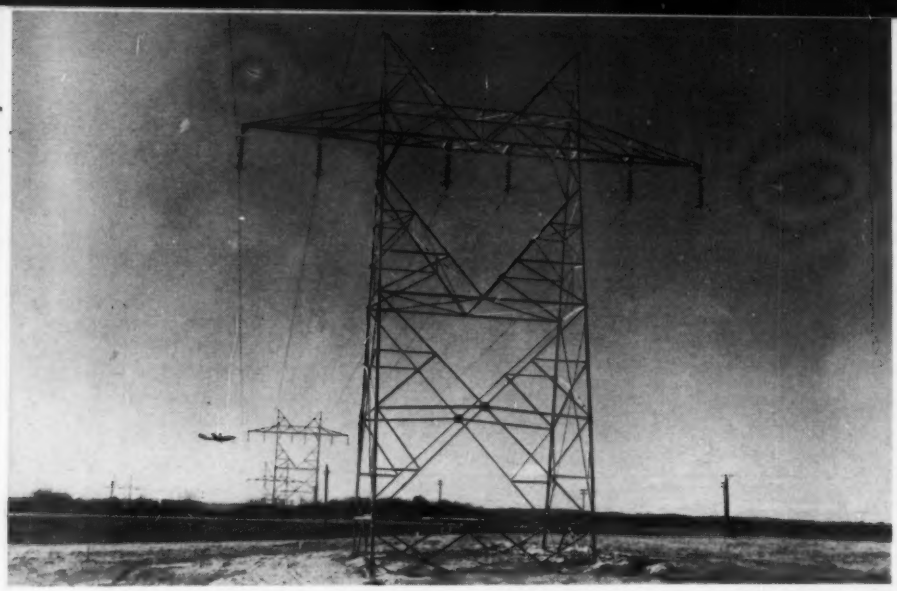
Required for Typical 7500-Kva Transformer



Pennsylvania has designed and built virtually every size and type of furnace transformer now in use: from 250 through 25,000 kva, and from 3175 through 82,000 amperes. To put this furnace transformer experience to work for you, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA FURNACE TRANSFORMERS



Towers Designed for Minimum Height

Special consideration for the reduction of aircraft landing hazards for adjacent Westover Air Force Base went into the designing of these 115-kv, double-circuit towers built by Blaw-Knox for Western Mass. Electric.

Each of the line's 66-ft-high towers is equipped with six 336.4-Mcm ACSR conductors and two overhead ground wires. Minimum ground clearance for the lowest line is 25 ft. Tower span is 608 ft.

Anaconda Ships First Cable Of Extra-Hi-Voltage Line

Anaconda Wire & Cable's entrance into extra-high-voltage cable development and manufacture (EW, April 13, p 92) is marked by shipment of this 138-kv pipe-type cable to Consolidated Edison. It is the first cable supplied by the new Anaconda plant at Hastings, N. Y.

The cable is connected to other cable laid on the floor of the Narrows, broad entrance to New York Bay, at both the Brooklyn and Staten Island sides. It will link the utility's Travis station with the Hudson Avenue station.

Moloney Develops Flexible Substations

Six standard arrangements of integrated substations, now offered by Moloney Electric, provide wide flexibility in meeting both present and future service requirements of outlying areas. The company explains that one arrangement is easily converted to another by adding switches and/or a recloser.

The standard arrangements are: (1) single-circuit with bus disconnect, (2) single-circuit with bus and load disconnects, (3) single-circuit with bus and load disconnects and by-pass switch, (4) double-circuit with bus disconnects, (5) double-circuit with bus and load disconnects, and (6) double-circuit with bus and load disconnects and by-pass switch.

MANUFACTURERS BRIEFS

Pennsylvania Transformer Div, McGraw-Edison, recently installed corona detection equipment for transformer insulation tests. The apparatus serves as a check on present production and helps in planning for higher voltage transformers. Among other applications, the highly sensitive test equipment is used in developing the transformers which the company is supplying to Pennsylvania Electric for its proposed 13-mile, 460-kv line (EW, April 13, p 67; April 20, p 110) . . . **Osmose Wood Preserving** is developing a tin derivative wood preservative said to be ten times as toxic as penta and offering anti-leaching characteristics. The company's lab has been doubled in size and personnel within the year . . . Construction of **Brown Co's** Bermico conduit plant near Birmingham, Ala, started two weeks ago and is scheduled for late '59 completion . . . **Philadelphia Insulated Wire** is building a 50,000-sq-ft plant on a 10-acre tract in Moorestown, N. J., for producing insulated wire and cable. It should be ready by August 15 . . . A 200,000-sq-ft condenser for a new 327-Mw turbine-generator, both **Allis-Chalmers** products, recently went into service as components of Commonwealth Edison's Fisk Station Unit No. 19 . . . **Okonite** has installed a 15-kv cable running 3,000 ft from a dredge to the shores of Los Angeles, where power is supplied. The cable's construction is: three conductors, each 350 Mcm, with Semicon tape, oil-base rubber insulation, tinned copper shielding braid, rubber fillers, double-wrapped tape and reinforced neoprene overall . . . **Leeds & Northrup** will supply Public Service Electric & Gas Co of N. J. with a data-handling system for two units at Mercer station near Trenton, costing about $160,000 . . . **Ohio Brass** and its subsidiary, **Holan Corp,** purchased Universal Hydraulics, maker of hydraulic components, to be operated as a subsidiary of Holan. Immediate expansion of production facilities and addition of products for hydraulic service are planned. . . . **Springfield Boiler** will make and erect three 235,000-lb.-per-hr water tube steam generators for Medina Electric Co-op, Hondo, Tex.

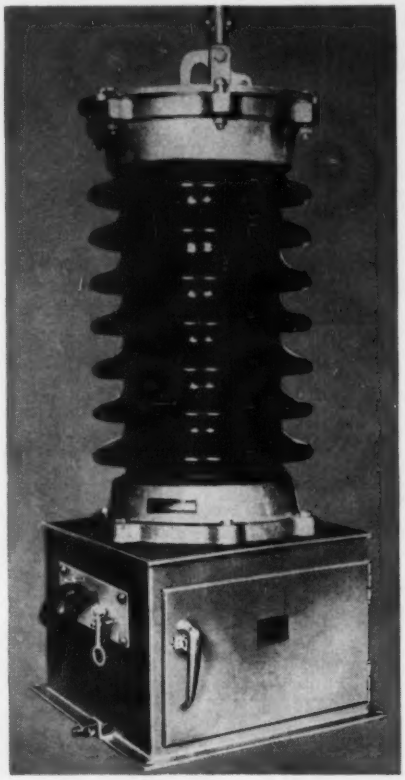
The New Standard in ALUMINUM LIGHTING STANDARDS

by READCO

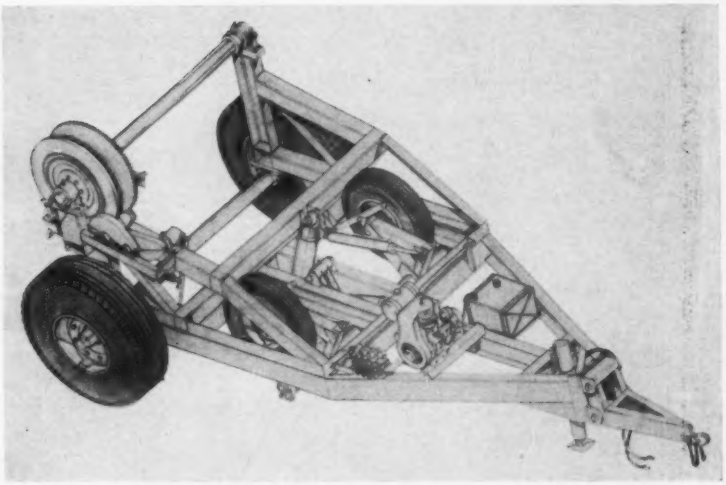
READ STANDARD, YORK, PA. • A DIVISION OF CAPITOL PRODUCTS CORPORATION

(For further information refer to Reader Service on page 70)

Potential Indicator . . .

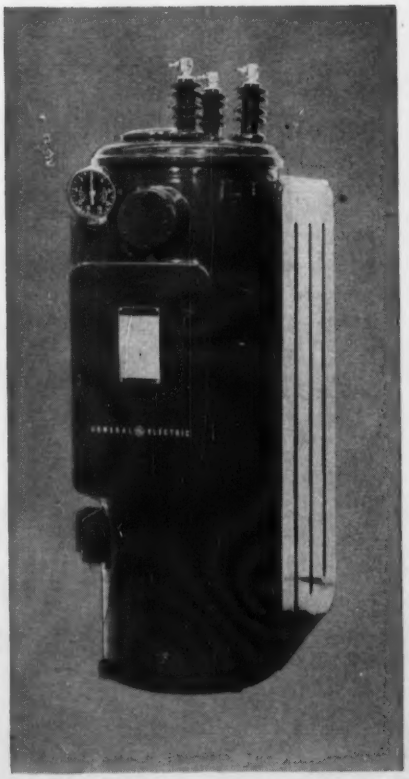


. . . for high-voltage transmission lines up to 345 kv is now available. The new capacitor unit is used for unattended substation potential indication, automatic "throwover" initiation, potential indication during maintenance, and as a source for oscillograph records. Future designs will allow the use of the capacitor potential indicator at voltages up to 750 kv.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



Powered Reel Carrier . . .

. . . loads, unloads and hauls reels up to 18,000 lb and 8 ft in diameter. The 7100 PRC Powered Reel Carrier requires 10 ft in overall width to carry large size reels, but it reduces to an 8-ft width for moving from site to site to conform with highway width regulations. A one-cylinder Wisconsin engine raises and lowers the reel.
Petersen Engineering Co, Inc, Santa Clara, Cal.



Step Regulators . . .

. . . feature four design improvements that provide better performance, easier maintenance and greater safety. Flat-panel cooling radiators replace the hollow-fin radiators formerly used. Panels are machine welded, reducing the chances for imperfect welds. The position indicator has a flexible drive shaft. Nine internal control circuit connections are mounted on one plug-in connector. New tanking guides assure positive positioning of core-and-coil assembly.
General Electric Co, Schenectady 5, N. Y.

(More New Equipment on Page 64)

TRIANGLE
has a cable for every STREET LIGHTING SYSTEM

Each street lighting job has different requirements calling for a specialized type of cable. Triangle has four basic types—each designed to handle a specific set of service conditions. The distribution engineer can select the *one right kind* for his situation, eliminating costly overdesigning and preventing system outages due to underdesigning.

* Triozone insulated, Trioprene sheathed—Series Street Lighting Cable. Single conductor cable for direct burial and duct installation. 2001 to 5000 volts.

* Rubber insulated, lead sheathed—Series Street Lighting Cable. Single conductor cable, available with or without double steel tape armor. 0 to 5000 volts.

* Trioseal or Triolene insulated—Series Street Lighting Cable. Single conductor cable. Extra thickness of insulation available for severe service. 0 to 5000 volts.

* Trioseal insulated, Triolene sheathed—Pole and Bracket Cable Twin conductors. 4001 to 10,000 volts.

These cables are described in a new bulletin, just off the press.
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No special skill is needed to expertly apply Superformed Products. When the last rod snaps into place you are assured of permanent, full-length gripping protection against mechanical and electrical damage.
The unexcelled Superforming process of making helical reinforcements is another development of Fanner's long years of specialized wire-forming experience. Write for catalog showing complete lines.
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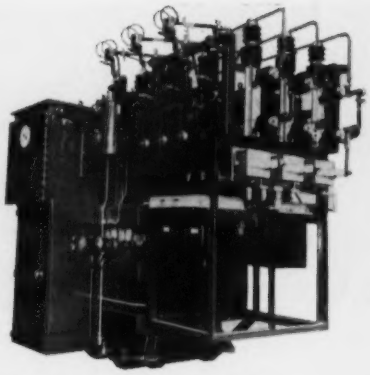


Integrated Substations . . .

. . . in six standard arrangements are now available. Arrangements now offered include either single or double-circuit with bus disconnects, bus and load disconnects, or bus and load disconnects and by-pass switch. One arrangement is easily converted to another by adding switches and/or a recloser.
Moloney Electric Co, St. Louis 20, Mo.

Multiplex Equipment . . .

. . . is designed for high speed, highly reliable and secure protective relaying over a microwave base band medium. The MC-22 equipment operates in the 40-200 kc frequency band with 4-kc channel spacing. Up to 41 channels can be applied to a 6,000-Mc microwave base band channel without any intervening equipment or using any of the available voice channel capacity.
Motorola Communications & Electronics, Inc, 4501 W Augusta Blvd, Chicago 51, Ill.

Terminal Lug . . .

. . . for use with either aluminum or copper conductor is now available. Called the Reddy Lug, it has an indicating screw and contains sealed-in cable compound. Bared, clean conductor is inserted into bore and compression screw is tightened until appropriate marking on screw matches with cable size, indicating correct degree of tightness. A free plastic-handle wrench is included in

(Continued on Page 66)

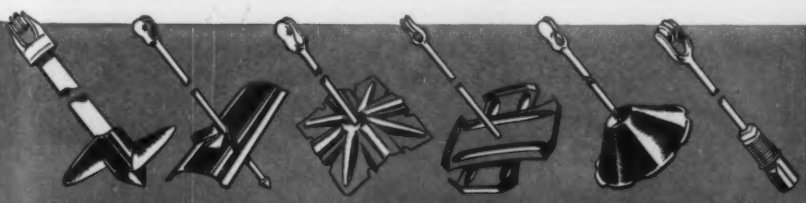
This line crew bores a hole for the pole, then fastens an adapter and screw anchor on the end of the bit. Screw anchor is installed without removing auger or bit.

CHANCE SCREW ANCHORS for speedy, cost-cutting machine installation

CA59-6

More and more utilities are cutting screw anchor installation time to the minimum by installing Chance Screw Anchors with their hole boring equipment. They use the Chance "Blackfoot" Screw Anchor because it is designed with fast-cutting, "pitch controlled" blades that can screw down rapidly with little earth disturbance. And, the King-size Thimbleye on these anchors easily fits the boring machine adapter. Chance Screw Anchors come in a range of sizes from 4" to 15" in diameter. You can get them from stock in most areas.

Send for your copies of "ANCHORING," the most complete guide to proper anchoring ever developed. It shows you how to choose the right anchor for every condition—and how to install it properly.



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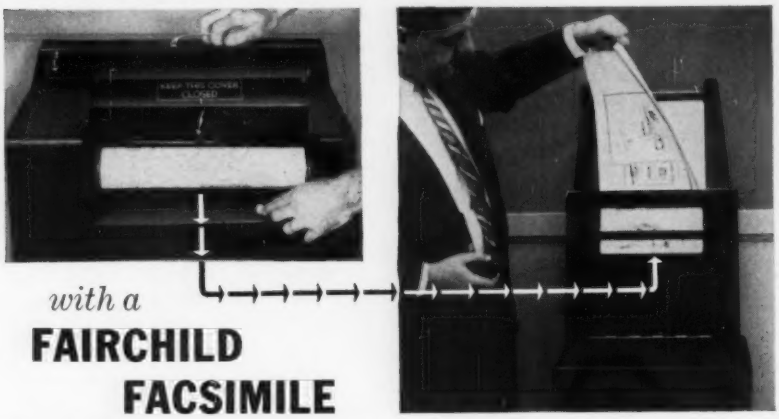

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Terminal Lug . . .

(Continued from Page 64)

each standard package, and it is the only tool needed. The lug is available in four sizes to handle a wire range from No. 8 to 500 MCM. **Thomas & Betts Co, 36 Butler St, Elizabeth, N. J.**

Rechargeable Battery . . .

. . . can be recharged from a 110-v outlet. The battery is available in 2.5, 3.75 or 5.0-v sizes and replaces two "D" size cells. Prongs under the cap plug into a standard convenience outlet, and the battery may be charged over night.
Sonotone Corp, Battery Div, Elmsford, N. Y.

Oil Tester . . .

. . . may be used for on-the-spot testing of insulating oils in transformers and associated high voltage equipment. The Model 4505-A Hypot weighs only 42 lb, and overall size has been reduced. Test volt-

(Continued on Page 68)

DEVELOPED TO MEET YOUR NEEDS:

400/800 ampere *Dual Range* CURRENT TRANSFORMER

This new dual range transformer was developed to meet *your* needs. It combines greatly extended range with all these other features of BH-6 Transformers:

OVAL SHAPED WINDOW for greatest flexibility in application with the greatest usable opening of any 600 volt current transformer.

COMPACT DESIGN makes it easy to mount. It's the smallest, lightest transformer in its class.

COLOR CODING . . . BH-6 Transformers are color coded in standard resistor colors for quick identification. (The new 400/800 rating is molded in black.)

CERTIFICATION OF ACCURACY. . . A certificate of accuracy test is supplied with all Sangamo current transformers. They arrive ready for you to put on the line.

you asked for it... a 400/800 ampere rating in a BH-6 Current Transformer that could provide extended capacity for future growth after initial installation on the 400 ampere range. By using one or more primary turns, this one transformer can be used on loads ranging from 40 to 1600 amperes.

Now, you can drastically lower your transformer stock levels, sharply reduce expensive changeouts, and get 0.3 accuracy class on all loads from 40 to 1600 amperes.

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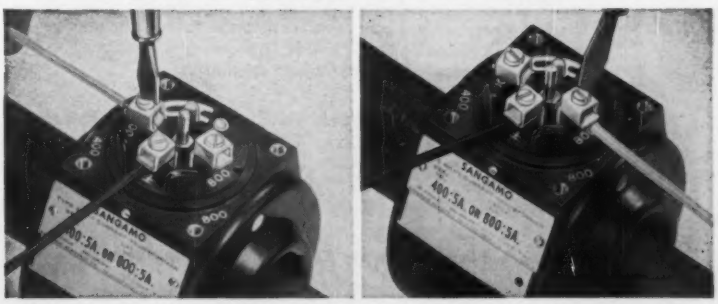

Changing range is as simple as 1-2-3. First, close the short circuiting link. Second, transfer the secondary lead from the 400 to the 800 amp terminal. Third, open the short circuiting link.

SM59-2

SANGAMO *Electric Company*
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CONTINENTAL ASBESTOS-INSULATED
POWER CABLE

***TYPE AVA TO 5000 VOLT SERVICE** available sizes: 14 AWG to 1,000,000 CM inclusive. Conforms to N.E. code standard and NEMA standard WC1-1955 and ASA C8.-36-1955.*

Engineered insulated wire and cable from Continental Wire assures maximum Job-Dependability.

Type AVA Power Cable is recommended for use in open or in conduit installations where advantages of excellent current carrying capacity and resistance to high temperature are desired . . . and where operating conditions include oil, grease, corrosive vapors or moisture.

There's a complete line of Continental Insulated Power Cable in sizes 14 AWG to 1,000,000 CM inclusive . . . insulation types include AVA . . . AIA . . . V . . . AVB . . . Silicone Rubber . . . Glass . . . Teflon Tape . . . and Varnished Glass Tape.

For more information write Continental, Wallingford.

continental wire corporation

WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

Oil Tester . . .

(Continued from Page 66)

age is continuously adjustable from 0 to 35 kv ac at a 2-kva rating to meet ASTM and Federal Specifications. The set operates from 110-120 v ac.

Associated Research, Inc, 3777 W Belmont Ave, Chicago 18, Ill.

Line Trucks . . .

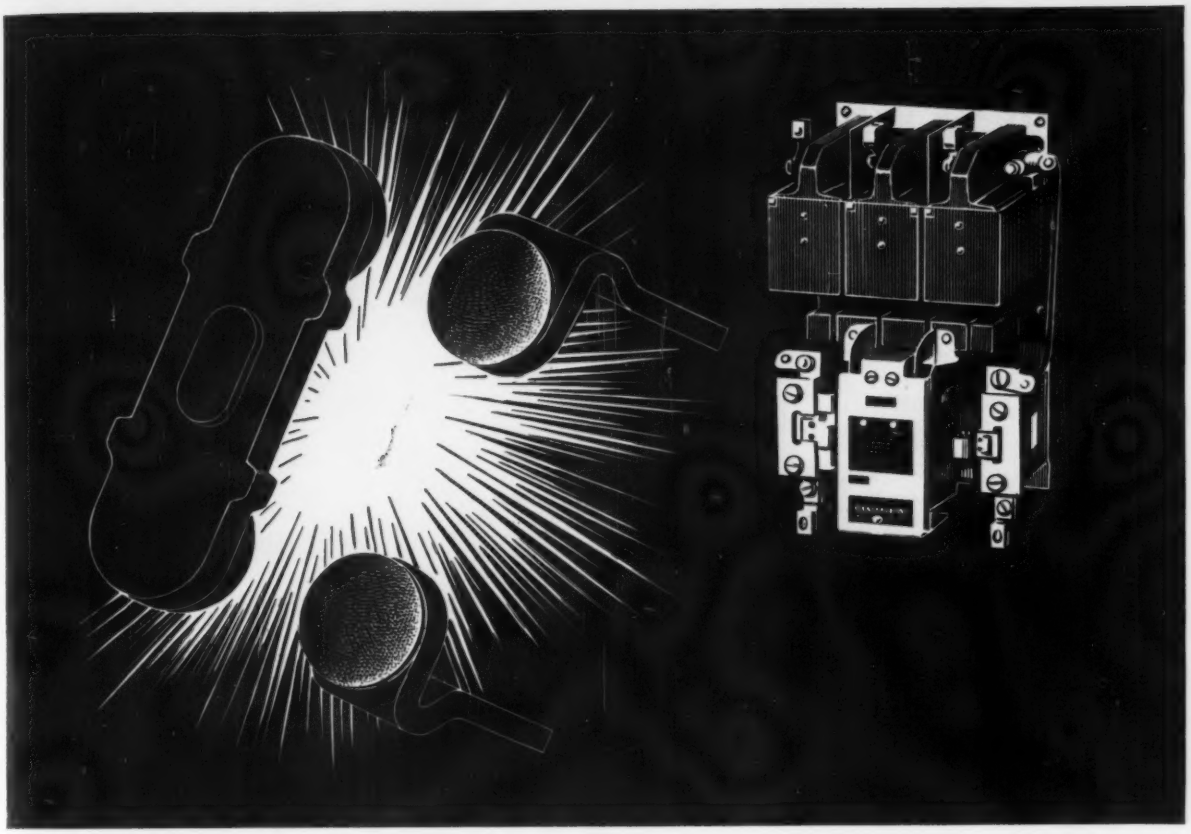
. . . provide versatility and work capacity for use where job requirements do not call for heavier equipment. They are designated the "C Series". Both C-4 and C-5 units have all equipment necessary to dig holes, set poles up to 40 ft long and do general maintenance work. The C-3 is an inexpensive pole-setting light utility truck.

Tel-E-Lect Products, Inc, 10001 Minnetonka Blvd, Minneapolis 26, Minn.

Transformers . . .

. . . using thermosetting resin embedment are available in 3-phase models in nine and 15-kva rat-

(Continued on Page 70)



For Dependability in Power Contactors Specify Mallory Contacts

It pays to be particular about the contacts that go into the motor controllers, line starters and power contactors you buy. The reliability of this type of equipment . . . and of any other circuit-switching device . . . depends considerably on the contacts used in them. Just "any good contact" isn't good enough for this service.

For the special requirements of power contactors, Mallory has developed a series of silver-cadmium oxide materials with unusual properties. They are unequalled in their resistance to welding . . . will take several times the current that would weld fine silver contacts of the same size. They have low contact resistance which results in low temperature rise in high current circuits. These materials withstand the heavy arcing and severe duty cycles characteristic of motor control service, showing low rate of arc erosion and wear.

A unique Mallory development, silver-cadmium oxide contacts are the choice of leading contactor manufacturers. They are part of a broad line of materials created by Mallory pioneering in powder metallurgy techniques. Don't settle for less than Mallory quality and performance.

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MAY 11, 1959

Transformers

(Continued from Page 68)

ings. The Type EPT transformers can serve lighting loads, appliances or machine tools. The units are available in the 5,000-v class or below.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Cable Shield . . .

. . . may be used above or below ground, wherever steel protection is needed. Known as Cablegard, the split-pipe shield is available in curved or straight lengths of five usable feet. A clamping tool forms a 90-deg clip after the two halves have been placed around the cable.
Butler Mfg Co, 7400 E 13th St, Kansas City 26, Mo.

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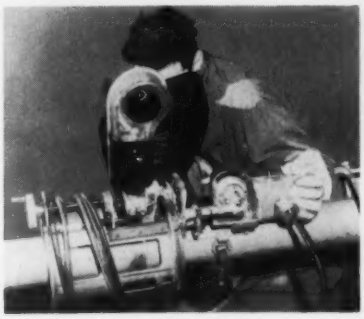
. . . offer an economical, efficient method of splicing two ends of wire or strand. Known as Fannsplices, the strand splices are essentially groups of Fanner's Superformed helical splicing rods which have been pre-assembled into sub-assemblies coated internally with high-friction material. Fannsplices may be hand applied without the use of tools or compressors.
Fanner Mfg Co, Electrical Products Div, Dept A-5, Brookside Park, Cleveland 9, Ohio.



Pipe Welder . . .

. . . weighs less than 50 lb and is easily portable. The unit operates from conventional engine-driven dc power sources. The circumferential welder is held in position by a strap clamp, and the welding gun and cable drum gear travel around the horizontal axis of the pipe.
Aluminium Limited, 620 Fifth Ave, New York, N. Y.

Faultfinder . . .

. . . locates grounds on ac or dc systems up to 600 v. The Brunt Faultfinder, a combination ground detector and fault locator, may be used while the system is energized. Imposing only 2 amp on the circuit, it cannot damage line equipment. The instrument weighs only 18 lb.
Parr Mfg Corp, 44 Austin St, Newark, N. J.

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You can choose a powerful V-8 or thrifty Six, 3- or 4-speed transmission—even push-button automatic LoadFlite. See your Dodge dealer about this Tradesman, or any Dodge truck up to 49,000-lb. G.V.W. Power Giants. Find out why . . .

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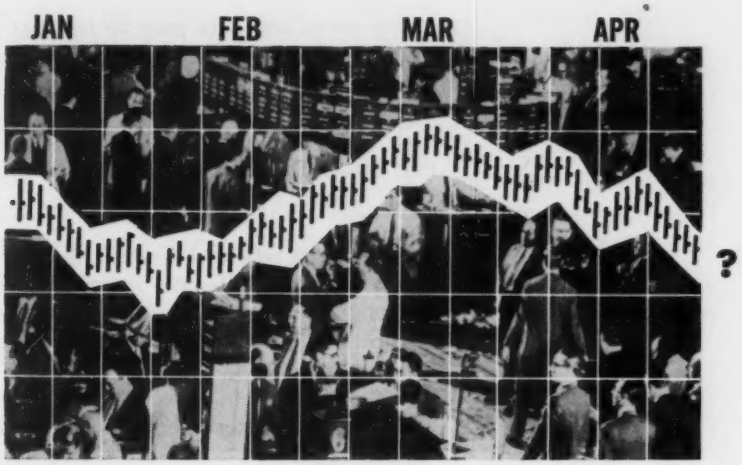


Utility Stocks in the '59 Market

How do electric utility common stocks compare with the industrials in 1959's uncertain market? The way investors feel about this multi-million dollar question will affect not only their own capital gains or losses, but also the utilities' financing costs. By the end of the year, statisticians will measure the answer. Meantime, however, there's a case to be made for the proposition that utilities offer the best offensive-defensive combination on the market today.

The market is always uncertain. But an observer would have to dig deep into his memory to come up with a set of market conditions any more confusing than the ones that are influencing the price of stocks right now: After having rocketed upward in the face of last year's poor earnings reports, the market averages have begun to calm down just as announcements of record profits have begun to flow in. The threat of inflation has been tightening its grip on the minds of many sophisticated investors at the very same time that the Consumer Price Index has been building up its longest run of stability since prior to World War II. Recently published comments on the market's future range all the way from predictions of 800 on the Dow Jones Industrial Average to grim warnings replete with references to 1929.

The market's uncertainty is not due to uncertainty about business. Economists and business leaders are nearly unanimous in predicting for 1959 a continuation of the prevailing uptrend in business activity and corporate earnings. It isn't easy to find a business barometer that doesn't indicate fair weather ahead. The question is: "How much of the fair weather has already been discounted by the phenomenal stock price rises of the past year?"

During 1958 (and since) most leading stocks have risen to all-time peaks. The Dow Jones industrials last year registered a 34% gain over 1957, while Standard & Poor's industrials climbed 37%. The New York Times' average of 50 stocks (including industrials, utilities, and railroads) also rose 37%. The cause for concern is not this high level alone, but the fact that these levels are related to per-share earnings and dividends far below the traditional standards. For in 1958 if industrial stock prices rose like mercury, earnings and dividends sank like lead. The Dow Jones industrials, while appreciating 34% in price, marked 1958 with a 23% decline in per-share earnings. Price/

earnings ratios jumped from 12.1 at the end of 1957 to 21.2 at the end of 1958—a 75% rise in one year. One must go back to the "boom-bust" era of the late twenties to find leading stock averages priced so high in relation to earnings.

Utility stocks also have gone up fast, but their prices have not outrun earnings by nearly so wide a margin. During the 1958 run-up, prices of the Dow Jones utilities matched the industrials with a 34% gain. But the utilities' earnings rose by 5.5% during the year, in contrast to the 23% drop in industrial earnings. Price/earnings ratios of the utilities rose from 15.5 to 18.4—a bit less than 20%. Dividend yields of the utilities dropped about 20% during 1958, while industrial yields declined 32%.

Price/earnings ratio and dividend yield are both important indexes in evaluating common stocks. P/E ratio is probably the more important, since it includes the total earnings return on the investment (distributed and retained in the business), while yield reflects only the distributed portion. Present and future earnings appeal most strongly to investors in high income tax brackets, seeking growth and market appreciation rather than income; while higher dividend yield attracts investors who desire larger cash income.

Both of these indexes are flashing danger signals. A New York brokerage firm has developed a chart comparing price/earnings ratios of stocks to yields on high grade bonds. This chart shows that whenever the earnings return on stocks has fallen below the yield on these bonds, a prompt and drastic decline in stock market levels has always followed. Although the lines have not yet crossed, they are getting too close for comfort—with the stock ratio something over 80% of recent bond yields.

As for yields, a rare inversion condition already exists. Dividend yields on stocks penetrated below the average yields for high grade bonds in the summer of 1958, and slipped still lower as the year progressed. Early in 1958 the 500 stocks of all categories comprising the Standard & Poor's average showed an average yield of about 4.6%. A year later this yield stood at about 3.25%. During the same period, the average of high grade bond yields was rising from around 3.25% to about 4.10%. At this level the bonds offered a cash return more than 25% higher than dividends on stocks included in this average.

Another brokerage house recently completed studies indicating that the average price/earnings ratio for all industrial stocks listed on the New York Stock Exchange has averaged about ten times earnings during the post-war period. This is the traditional "ten-times" rule of thumb, which has been used by the financial fraternity time out of mind. With industrial P/E ratios of 21.2 and utility P/E ratios of 18.4, this rule was being flagrantly violated at the end of 1958. And there has been little correction in either the level or the relationship since the beginning of this year.

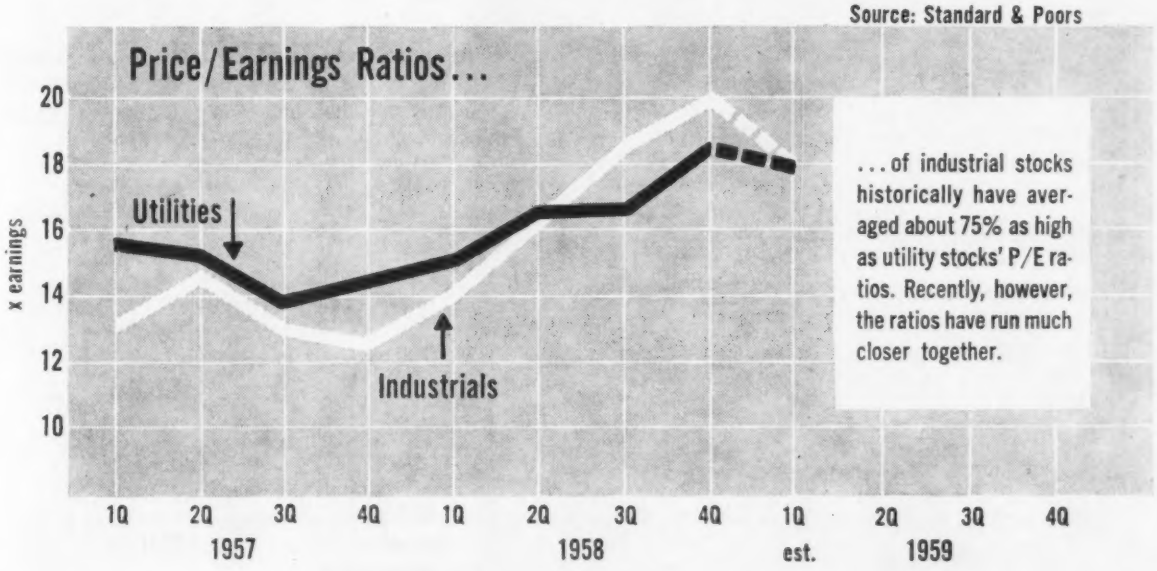
Let's examine the vulnerability of industrial P/E ratios a little further. It's hard to arrive at a truly "normal" relationship between the price/earnings ratios of industrial and utility stocks, but in the light of past experience it seems reasonable to assume that a normal average ratio for leading industrials would usually fall somewhere around 75% of the ratio registered by the leading utilities. Applying this very general assumption to the utility ratio of 18.4 (itself the highest in many years) would produce an industrial ratio of 13.8—or 35% lower than the 21.2 recorded at year end.

A large and usually reliable research organization associated with one of the more important mutual funds estimates an increase of about 22% in 1959 earnings for the corporations included in the Dow Jones Industrial Average. If this estimate proves to be correct, a 35% downward adjustment in industrial

price/earnings ratios would result in a 20% decline in prices by the end of 1959. If the ratio adjusted itself half way, the end of 1959 would find the industrial average hovering around its present price level.

The higher price/earnings ratios traditionally prevailing for utilities as compared with industrial companies have developed as a result of experience over a long period of years, and reflect the greater stability of utility operations and utility earnings. This stability is assured not only by the growth of the electric business—amply demonstrated during the recent recession—but by regulation. Either past history records a colossal blunder as to the relative values of the earnings dollars of industrial and utility equities, or else the industrial price/earnings ratio is now out of line to a degree which would seem to call for considerable downward adjustment.

Source: Standard & Poors



In times of stock market boom, price/earnings ratios get far ahead of such "over-the-years" norms as the "ten times" rule and the industrial 75% formula. And there are always superficially persuasive explanations as to why such exceptions are justified. In the past, however, proponents of such high earnings ratio theories have always been proven wrong by experience. There's always a first time, but it hasn't occurred yet.

Utilities will not be immune from any sizeable downward adjustment of P/E's, but it is likely that they would be affected less than industrials. First they are not as far above their norm as industrials. Second, in any decline, the utilities' excellent defensive record would help to hold prices up.

What if the market continues upward? The chances of a flight from utilities to industrials still appear slim. Inflation, while it has made industrial stocks more attractive to the capital gain seeker, has also shifted the attention of many large investors from bonds to utility commons. Writing in the thirteenth annual Public Utility Survey of the Investment Dealers' Digest, G. Leslie Fabian of Laurence M. Marks & Co pointed out that much of the money from balanced funds that has hitherto been invested in bonds, may go instead into utility equities.

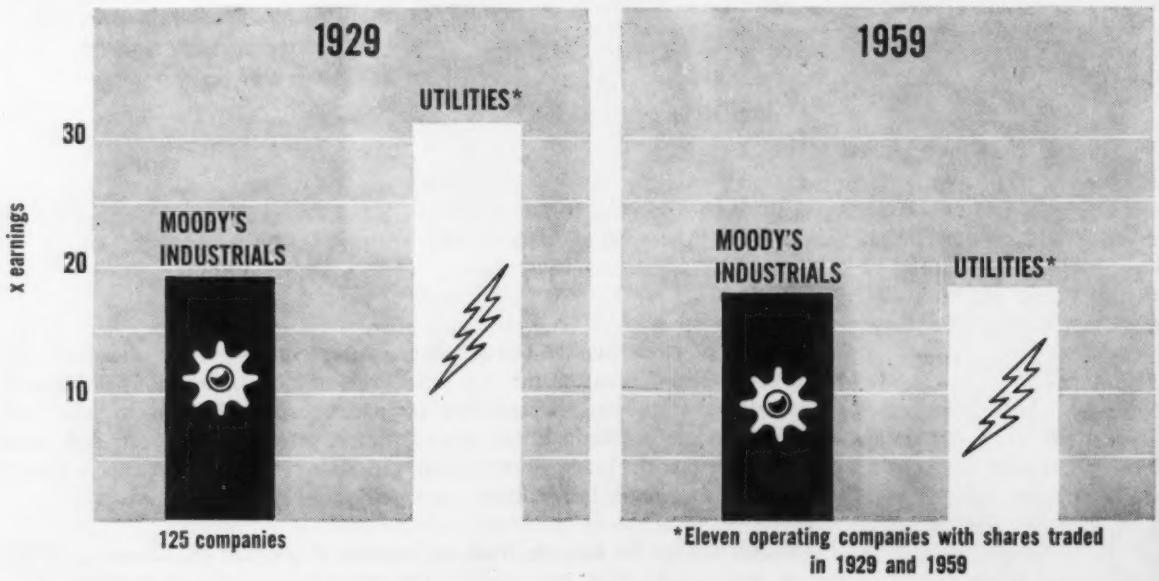
"In the eyes of those who really know the unique characteristics of the utility industry, the dividends on utility commons are getting to be regarded practically as safe as the interest payments on corporate bonds." At the same

time, while the bond holder runs the risk of seeing his interest—and perhaps part of his capital—devoured by inflation, ". . . holders of utility stocks may look forward not only to dividend increases, but they also have excellent historical bases for expecting their stocks to show market-price appreciation over the years." And dividends also hold an advantage in tax treatment.

The appeal of utility commons is not all on the conservative side. Tri-Continental Corp's Frederick W. Page pointed out last year that his company's utility portfolio—composed of some "growth" and some "income" stocks—had appreciated twice as fast as the Dow Jones industrials over the past ten years (EW, April 14, 1958, p 91). And this February the investment firm of Carl M. Loeb, Rhoades & Co published a study of nine "growth" utilities, showing that the nine have almost tripled in price since 1953. Further, the study estimates that per-share earnings of the same nine utilities will show gains ranging from 27% to 58% above their 1957 levels by 1961.

These growth utilities were selling at an average of 24 times 1958 earnings when the study was published. This is a high ratio indeed compared with historical standards, but it is interesting that these most "speculative" of utilities sell no farther from the norm than an *average* of leading industrials.

Utility P/E Ratios Are Well Below '29 Levels



Even the growth utilities, incidentally have not even come close to the price/earnings ratios that were prevalent among utilities at the 1929 high. The chart above shows P/E levels of a group of industrials and a group of utilities at the '29 peak and how the same groups compare today. The utility group is composed of eleven operating companies whose common stock was traded in 1929 and is still traded today. No holding companies are included. Whereas the group sold in 1929 for an average of 31.2 times 1929 earnings, the same companies current price/earnings ratios average out to 18.8. Moody's 125 industrials are also still selling below their 1929 P/E ratios. The margin, however, is somewhat slimmer—18.03 as of last month vs. 19.5 at the 1929 high. Market conditions today are not much like those in the intensely speculative atmosphere of thirty years ago, but these ratios indicate that utility commons, at least, are not inflated beyond historical precedent.

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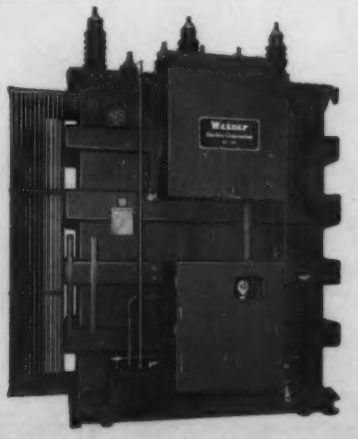
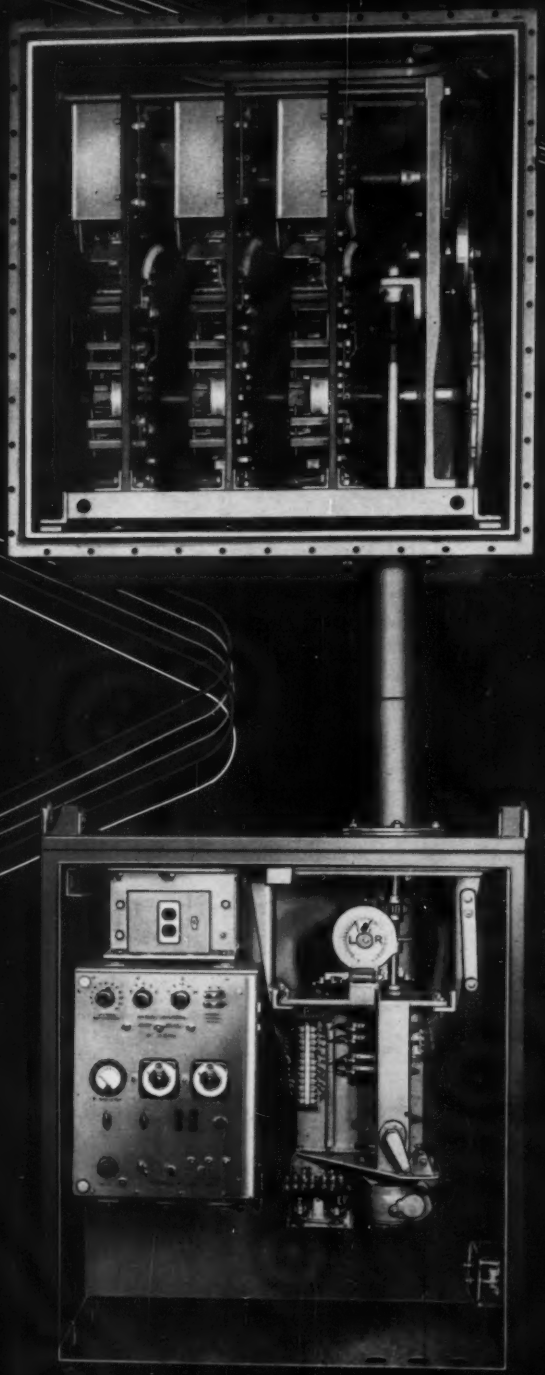
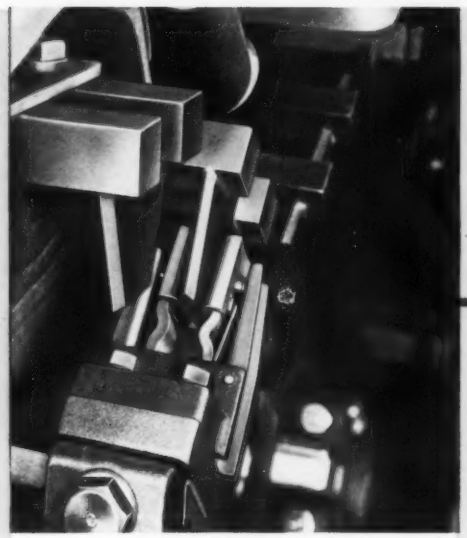
TRANSFORMERS





WAGNER LOAD TAP CHANGING M

offers these advantages...

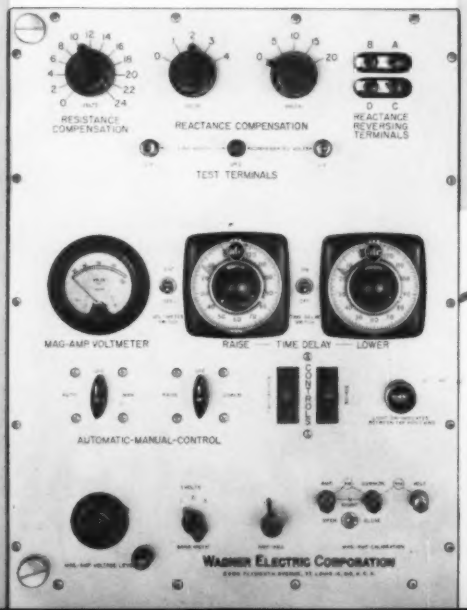


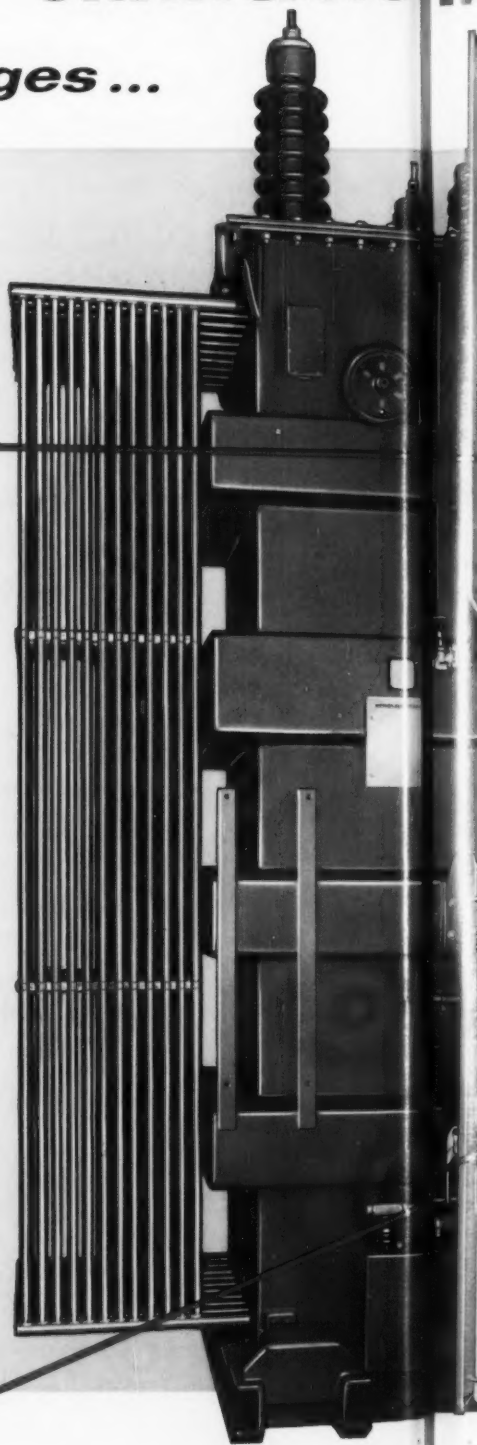
MAXIMUM LIFE CONTACTS

All switch contacts, both moving and stationary, are alloyed copper for maximum resistance to wear... reliability proved by life tests far exceeding normal operating conditions. Moving contacts self-aligning... free parallelogram action assures maximum contact area with constant pressure.

MAGNETIC AMPLIFIER CONTROL

Magnetic amplifier control eliminates moving contacts in the voltage sensing circuit... provides simplified and highly accurate band width control.

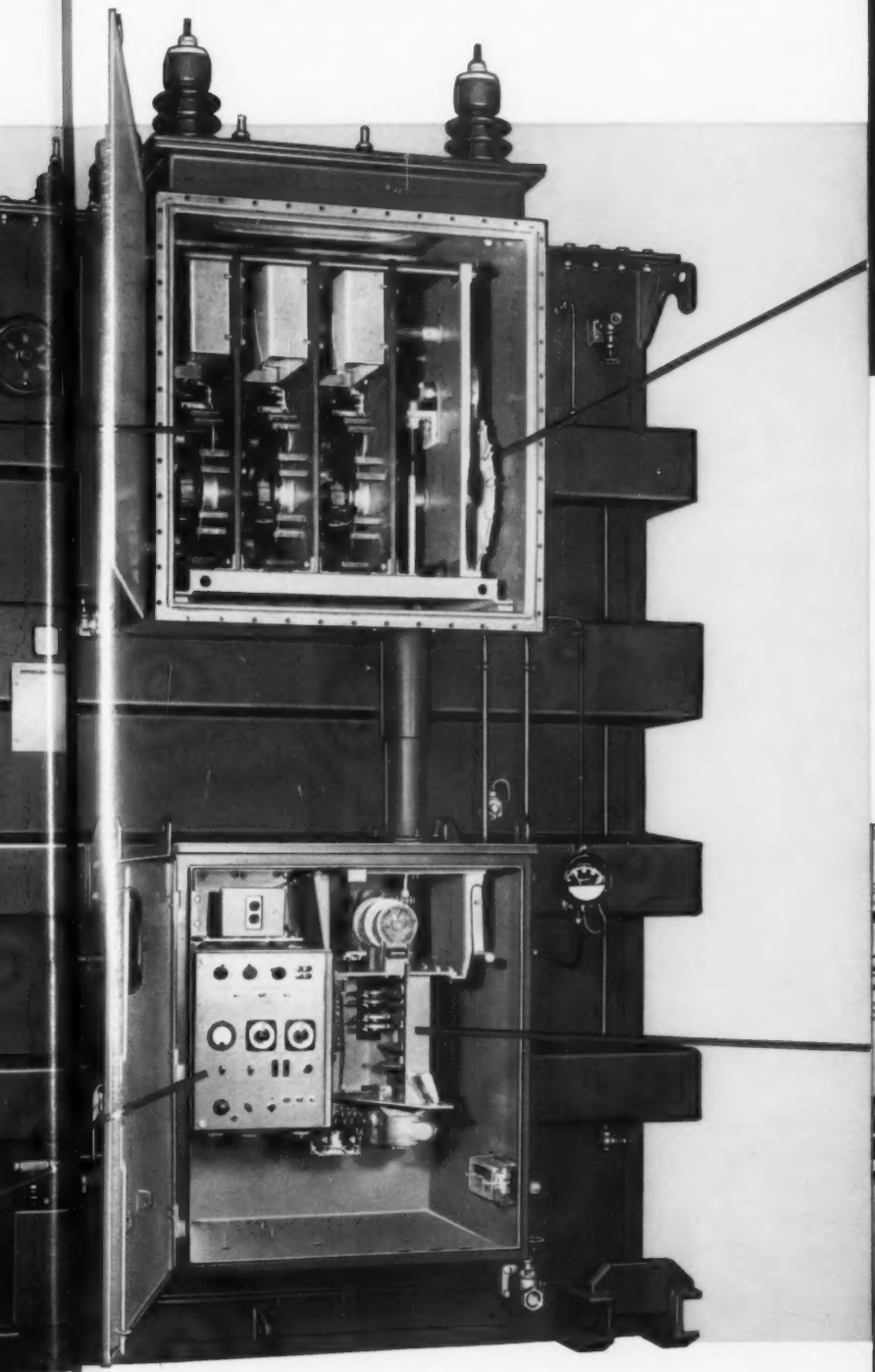


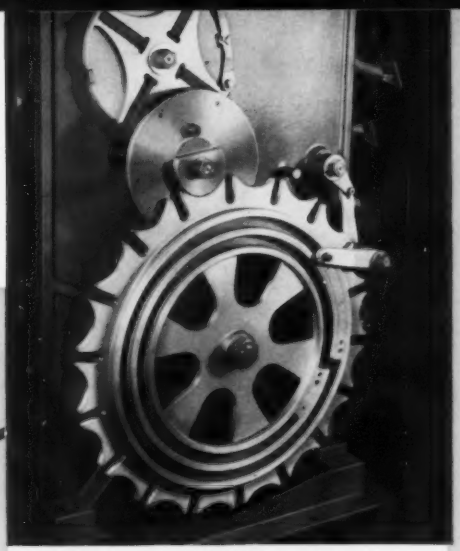


Wagner Electric Corporation

6400 PLYMOUTH AVE. ST. LOUIS 14, MO.

IG MECHANISM



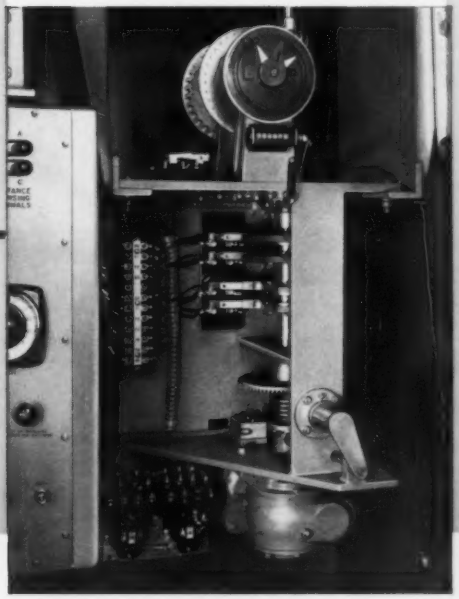


ONLY 2 GENEVA GEARS

The two Geneva gears operate from a single drive pinion, and are designed for 90° entrance to reduce noise of operation. The reversing switch operates from a cam in the face of the tap selector gear which has a positive mechanical stop to prevent over-travel.

SINGLE SHAFT DRIVE

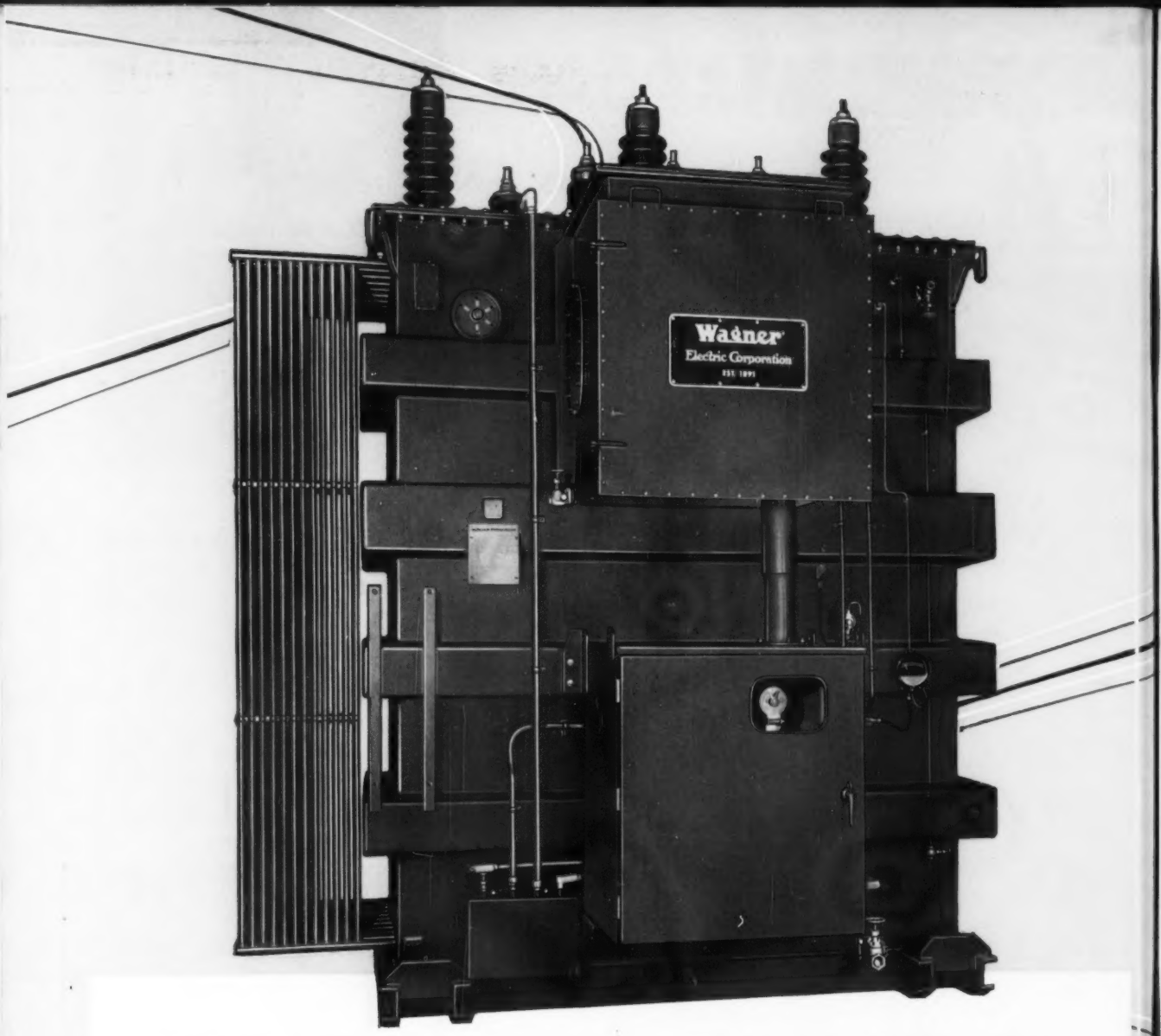
A single main drive shaft, geared to the drive motor and to the drive pinion, operates the tap selector switch and the load transfer switch. This shaft also operates the position locating switches and the position indicator.



Here is a compact, extremely simple power transformer load tap changing mechanism, using a single drive shaft and one set of miter gears to assure quiet operation.

Magnetic amplifier control means higher accuracy in the voltage sensing circuit, and greater reliability since no moving parts are necessary.

The design simplicity of the Wagner load tap changer ... in the drive mechanism, the transmission assembly, the switches and the control circuit ... results in long, efficient operating life with freedom from maintenance.



WAGNER LTC POWER TRANSFORMERS

Wagner Load Tap Changing Power Transformers are designed and built to meet the most exacting requirements of modern utility companies. The mechanism is unusually simple, to give users the benefits of longer operating life—quiet operation—and freedom from maintenance.

Wagner Load Tap Changing Transformers can be built in all popular kva and voltage ratings to meet your requirements.

Constant research and development have kept Wagner up front in transformer design for more than 65 years—made the name Wagner one of the foremost in power planning.

For full information on these Load Tap Changing Power Transformers, consult your nearby Wagner Sales Engineer. There are Wagner branches in 32 principal cities.

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WT59-9

Wagner Electric Corporation

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SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL . . . AUTOMOTIVE*

Coulbourn, Elliott Elected Vice Presidents

COULBOURN

Edward R. Coulbourn and Douglas F. Elliott have been elected vice presidents of Alabama Power Co. Coulbourn is vice president in charge of engineering, and Elliott is vice president in charge of construction.

Coulbourn joined Alabama Power in 1924 as office engineer-distribution. He became chief electrical engineer in 1944 and manager of engineering, his most recent post, in 1951.

Elliott joined Alabama Power in 1924. His posts have included assistant manager of construction, assistant manager of engineering, and construction manager.

ELLIOTT

Potomac Edison Names Bowen to Vice Presidency

Potomac Edison Co has named A. J. Bowen a vice president.

He had been director of district operations since April of last year. He will continue to be responsible for personnel, customer services, policies, public relations and other similar matters in the company's major operating districts.

Prior to his appointment as director of district operations, he had served as manager of the company's Winchester, Va., district.

He joined the company in 1929 as a meter reader, and was made local manager at Berryville, Va., in 1933. Four years later, he transferred to Piedmont, Va., and in 1940 was made assistant district manager at Martinsburg. He returned to Winchester in 1942 as assistant district manager and held that post until he was made manager in 1947.

Francis, Murray Appointed to New Posts at U.S. Steel

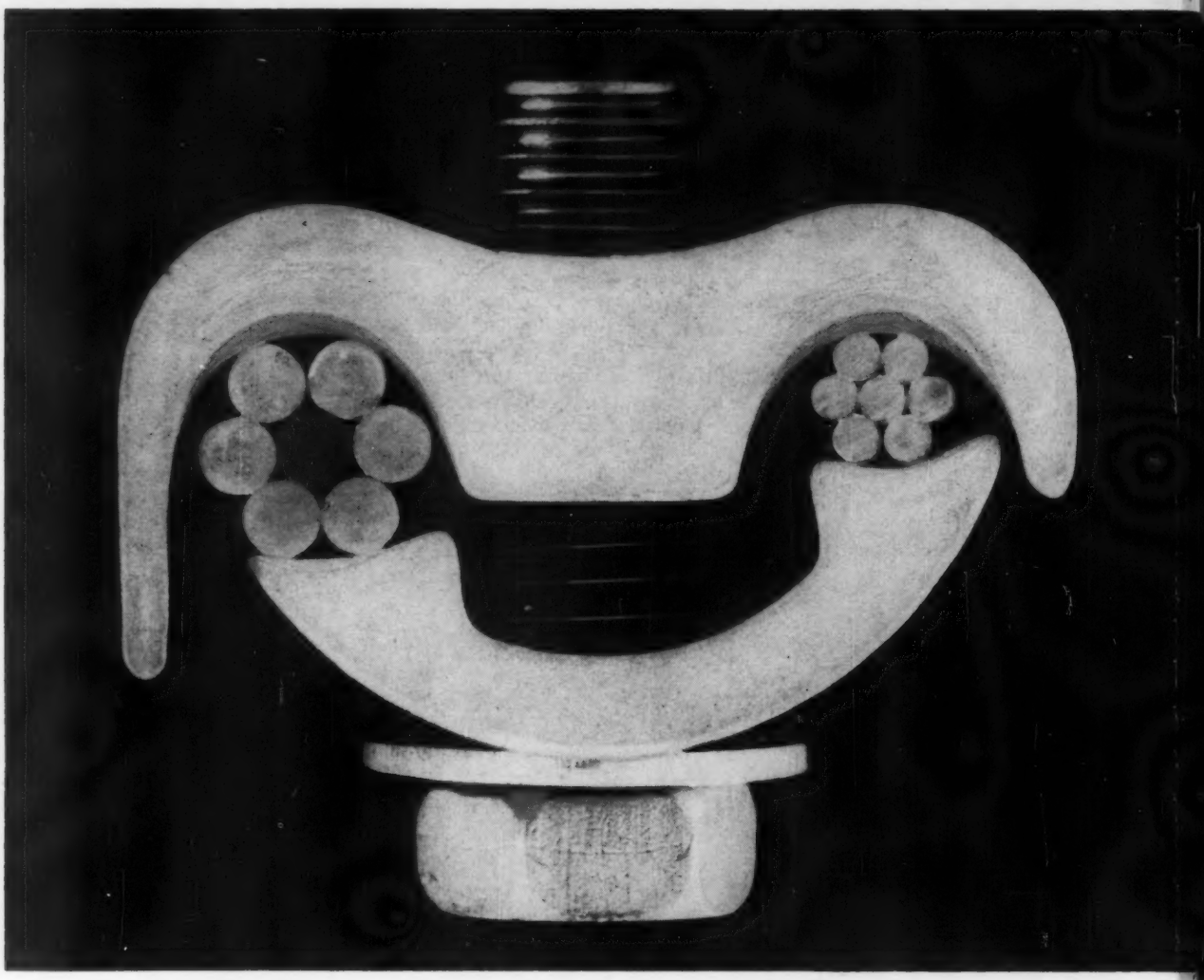
Harry M. Francis has been appointed executive vice president and Edward A. Murray vice president-sales of American Steel & Wire Division, United States Steel Corp.

Francis had been vice president of sales for the past 13 years. He was made assistant general sales manager in 1937, assistant vice president in 1938, and vice president of sales in 1946.

Murray was named assistant manager of manufacturer's product sales in 1944 and, a year later, manager of product sales. In March, 1958 he was appointed assistant vice president-sales.

(*More News About People on page* 84)

FRANCIS MURRAY



NEW ALCOA CLAMP

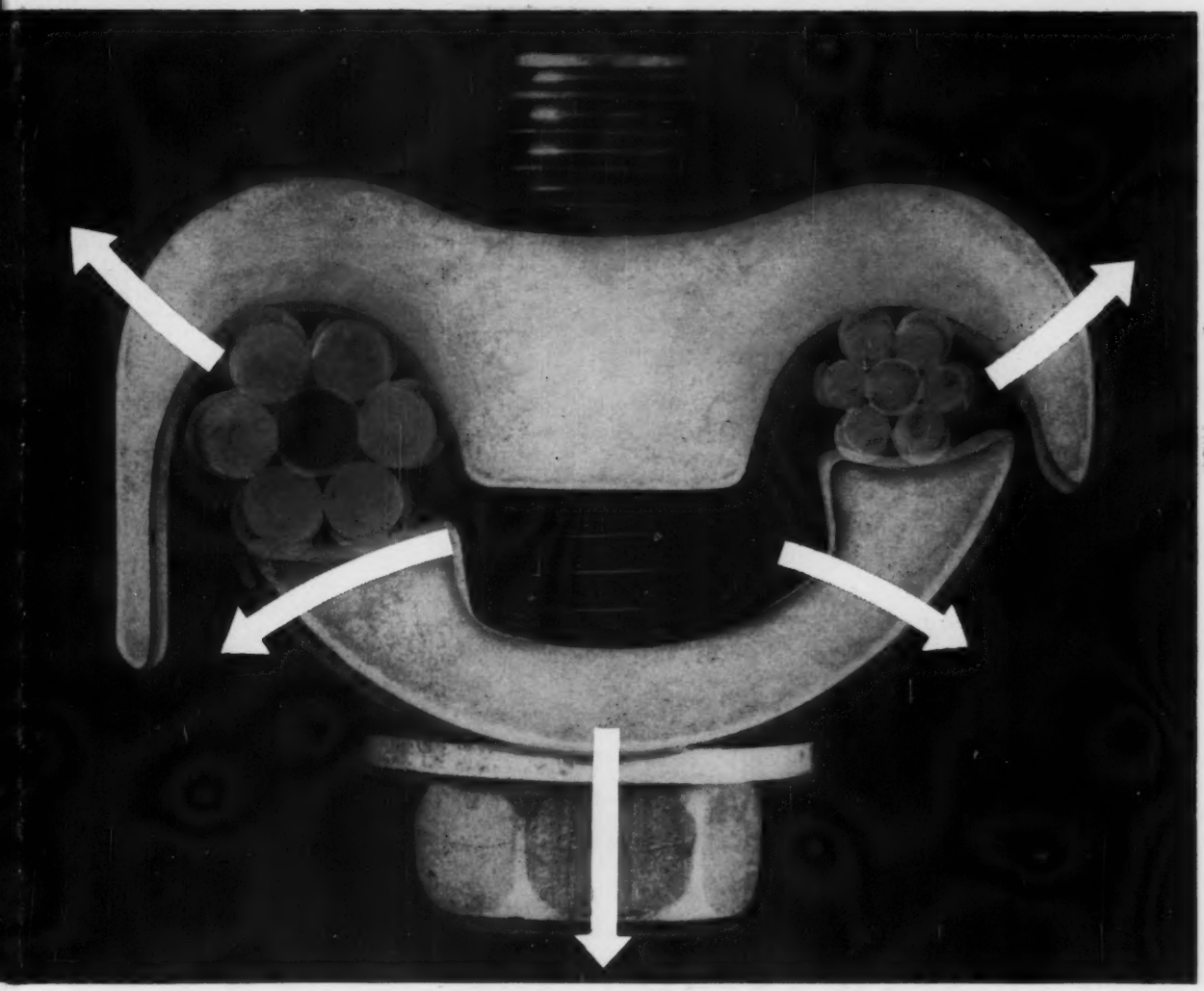
Alcoa Clamps and Connectors Flex with Thermal Changes to Provide Safer, Longer Lasting Connections

Exclusive flexing-action design of Alcoa clamps and connectors gives good conductor contact regardless of thermal changes . . . eliminates the costly problems caused by excessive relaxation.

Here's how this works:

During normal, gradual temperature increases, excess pressure on the conductor is avoided by even expansion throughout the Alcoa clamp. Because Alcoa clamps and connectors are all-aluminum, including the bolt, all components have the same coefficient of expansion.

Alcoa clamps and connectors also adjust during



Above is a pictorial representation of the flexing action Alcoa clamps undergo during thermal changes in conductor. This automatic built-in protection, exclusive with Alcoa clamps and connectors, permits the clamp to "breathe" with changes in pressure.

ACTUALLY "BREATHES"

current surges which cause sudden heating with insufficient time for temperature distribution. In these cases, the flexing action of the spring-like cap member and the stretch action of the aluminum bolt (which is three times that of steel hardware per unit of force) combine to ride with changing mechanical pressures. As cooling occurs, the Alcoa clamp *follows up*, retaining pressure to provide a stable electrical connection.

The entire line of Alcoa extruded clamps and connectors—both light and heavy duty—incorporates this exclusive flexing-action design principle. Why not ask an Alcoa sales engineer to show you what this unique feature can mean to you in terms of safer, longer lasting, maintenance-free installations. Aluminum Company of America, 2110-E Alcoa Building, Pittsburgh 19, Pa.

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Watch "Alcoa Theatre,"
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Westinghouse TELEDUCTOR Magnetic Amplifier

more protection, savings, accuracy in measuring a-c voltages and current converts instrument transformer output to d-c milliamperes

In the telemetering of high-voltage feeder circuits or transmission lines, new Westinghouse teleductors offer many new advantages which have been previously unobtainable.

GREATER SAFETY ... teleductor secondary may be open-circuited in current or voltage circuits without hazard to personnel and equipment

ECONOMICAL ... costs less than conventional systems which use multiple meters or interposing relays

LONGER LIFE, LESS MAINTENANCE ... completely static ... no moving parts to wear or fail

EASILY INSTALLED ... compact ... can be mounted in any position

ACCURATE ... linear output with both voltage and current input

GET ALL THE FACTS about the many ways new Westinghouse teleductors can put more savings and reliability in your telemetering operations. Contact your Westinghouse sales engineer. Or, write to Westinghouse Electric Corporation, Director Systems Department, 356 Collins Avenue, Pittsburgh 6, Pennsylvania. J-01013

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

EW Names Hochgesang Assistant to The Editor

C. F. Hochgesang has been appointed assistant to the editor of Electrical World magazine. He had been western editor since January, 1957.

Prior to joining EW, Hochgesang had extensive experience in the electrical field. He spent two years with General Electric Co, a year with Kellex Corp, four years with Carbide & Chemicals Corp in Oak Ridge, Tenn., and nine years with Bechtel Corp in various engineering functions.

A graduate of the University of Maryland, he is a registered professional engineer in California.

Ortmeyer Named Penn-Union Sales Manager

Clifford J. Ortmeyer has been named sales manager for utility products for Penn-Union Electric Corp.

He had been with Anderson Elec-

Helping the power industry grow

A massive transformer, the slender A-frame of a substation structure, a field construction desk, blueprints and rigging equipment help artist Stanley Meltzoff symbolize the vigorous growth and expansion behind America's electric power industry.

Reservoir of Field Experience

The 75 years' experience of United Engineers has been gained on hundreds of such projects as design and construction of hydroelectric and thermal plants and responsibility for installations that supply heating and process steam. We are accustomed to operate within established budget limits in the design and construction of power projects both large and small. And best proof of the flexibility and scope of our operations—and of client satisfaction—is in our long list of new projects for clients previously served.

Let UE&C skills and creativity augment the engineering facilities of your organization. We invite you to share and profit from our background of 75 years' experience.

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tric Corp, first in the Development and Design Department of Engineering, then in the Sales Department as sales application engineer for utility and distributor products.

Bibby Elected Executive VP of Remington Rand

Dause L. Bibby has been named executive vice president of the Remington Rand Division of Sperry Rand Corp.

Bibby recently resigned as executive vice president of Daystrom, Inc., where he served for three years. Prior to Daystrom, he was a vice president of International Business Machines Corp from 1949 to 1956. He was with IBM for 22 years.

Fluor Appoints Austin VP-Procurement

Edmund C. Austin has been appointed to the newly created position of vice president-procurement for The Fluor Corp, Ltd. He has been with the company since Jan, 1958.

Prior to joining Fluor, he had been with the Canadian Bank of Commerce as petroleum advisor and assistant general manager, and with the Arabian American Oil Co from 1939 to 1955 in Saudi Arabia, New York and San Francisco.

From 1942 to 1944 he was loaned to the United States Army, Ordnance Department, and in 1951 to the Petroleum Administration for Defense where he was in charge of foreign materials.

PERSONAL BRIEFS

William L. Reuell has been made general foreman of Electric Distribution at Lynn Gas & Electric Co.

Wesley W. Blish has been promoted to advertising manager of Wisconsin Electric Power Co.

T. M. Leps, has been appointed manager of organization and procedures for Southern California Edison Co.

Stephen A. Hammond, Jr., former president and general manager of Empresa Electrica de Guatemala, S.A., has been named assistant secretary of American & Foreign Power Co, and secretary of Ebasco International Corp.

Harold P. Chamberlain has been elected secretary and treasurer of Wisconsin Electric Power Co, and **John Dockendorf,** assistant secretary and assistant treasurer.

James J. Dickson has been named manager of reactor engineering for the Nuclear Products-Erco Division of ACF Industries, Inc. He will supervise ACF reactor projects.

Electrical Engineers Equipment Co has appointed **Thomas Hollingsworth** director of marketing.

Guy E. Warner has been named sales manager of process computers for General Electric Co's Computer Department.

This is a typical penstock in which USS "T-1" Steel could reduce over-all costs. USS "T-1" Steel has already been specified for use in three major penstock installations now under construction in Canada, Switzerland and India.

HOW USS "T-1" STEEL can cut the cost of penstock construction

The primary requirement of penstocks is *strength*, since they are, in effect, variable pressure vessels. To achieve the necessary strength with carbon steel often means extremely thick, heavy, hard-to-anchor sections. But, by using USS "T-1" Constructional Alloy Steel, weight and its attendant problems can be drastically reduced. Consequently, construction costs can be cut, installation time shortened, less welding required, handling simplified, smaller foundations required, etc. (See chart)

Such effective weight reductions are possible with USS "T-1" Steel because its very high yield strength (100,000 psi minimum) permits use of higher working stresses. And "T-1" Steel's exceptional toughness, even at very low temperatures, coupled with weldability, makes it the ideal construction material for penstocks, pressure vessels, scroll-cases and standpipes. In tests, welded ½-inch-thick vessels of this remarkable steel have withstood stresses of as much as 136,000 psi without bursting—even when chilled to 45° F below zero.

Investigate USS "T-1" Steel for penstocks. Write for a copy of our new booklet, USS "T-1." United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

Here's how costs could be trimmed in a hypothetical penstock installation by using USS "T-1" Steel.

PENSTOCK CONDITIONS:

Diameter	60 " I.D.
Length	5,975 feet
Maximum head	2,940 feet
Design stress	½ yield strength
Minimum thickness	⅝ inch

HOW USS "T-1" STEEL CAN SAVE ON MATERIAL, WELDING, PRE-HEATING AND STRESS RELIEVING

	Conventional Construction (ASTM A-285-C)	USS "T-1" Construction	Savings with USS "T-1"	Percent Saved
Weight of shell material	4,880,000 lbs.	2,100,000 lbs.	2,780,000 lbs.	57%
Cost of welding operations (estimated)	$ 65,000	$ 35,000	$ 30,000	46%
Cost of pre-heating and stress relieving (est.)	$ 55,000	———	$ 55,000	100%
Total cost—includes cost of material, foundations, fittings, handling, erecting and shipping	$1,220,000	$866,000	$354,000	29%

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Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

USS United States Steel

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• ACCESSORIES
• TANKS

Shaw-Perkins Transformer Cooling Radiators, design standard for the transformer industry, give you the *full* economy and dependability of thermo-siphon self-cooling. Sizes and models for any make or capacity of transformer, either rebuilt or new. MAX/FLO oval tubes assure optimum heat dissipating surface, free flow characteristics. Complete range of flanges, elbows, valves, and other accessories are available for all mounting conditions.

Transformer tanks, another product of Shaw-Perkins specialized engineering, are built to customer specification, in sizes from pole line distribution types to power transformers up to 3750 KVA.

Write today for information and new catalog on transformer radiator and tank accessories.

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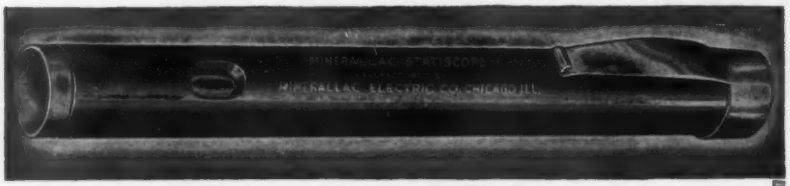

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. . . when held in any alternating electrical field. Indicates presence of voltage in AC and Pulsating DC Circuits and in various electrical apparatus. . . . Pocket-size illustrated above, also in Station and Overhead Extension types. Thousands in use. Order from Electrical Jobber. Send for new literature.

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H-3

Carl M. Dunn has been named Huntington division promotional and sales representative for Appalachian Power Co. **Nicholas Roomy, Jr.,** has been named sales supervisor for the district.

Westinghouse Electric Corp. has named seven regional managers to coordinate the support of utilities and builders in effecting the company's Total Electric Home program. They are: **Francis X. Winn,** Northeastern; **Harry A. Cheney,** Mid-Atlantic; **John G. Adams,** Southeastern; **Herman L. Wiler,** Central; **John T. Urban,** Northwestern; **Charles R. Beatty,** Southwestern; and **J. G. McKinley,** Pacific Coast.

Edward Diamond, associate general counsel of the Atomic Energy Commission, has resigned. He has joined the Stromberg-Carlson division of General Dynamics Corp as secretary and general counsel.

Babcock & Wilcox Co has appointed **Charles T. Smith** assistant marketing manager of its Boiler division.

William H. Dwyer, Jr., has been appointed manager of Mid-Continent and Gulf Coast Sales for Graver Tank & Mfg. Co, a division of Union Tank Car Co.

OBITUARY

Aloys A. Engelhard, 60, advertising manager for the Wisconsin Electric Power Co, died recently.

Henson E. Bussey, who retired from General Electric Co in 1950, died recently at the age of 74.

Alton W. Leonard, 85, retired president of the Puget Sound Power & Light Co, died recently.

William L. Rush, transmission and distribution engineer of Louisiana Power & Light Co. died recently.

George A. Whitely, Palouse division manager for Washington Water Power Co, and connected with the power industry since 1923, died in Spokane, Wash., recently of a heart attack.

ROEBLING GAS-FILLED CABLE!
looks out for your best interests!

Impregnated paper/insulation, with shielding.
Two steel spirals conduct inert gas to all parts of cable to prevent ionization and provide self-supervisory properties.
THE SHEATH ON THIS CABLE . . . is one more reason why it's a best buy! The Tellurium-Lead Alloy Sheath offers the best possible resistance to fatigue and age-hardening problems . . . has 90% less creep, 4½ times greater bending life!
Solid copper tubing is open at splices, assuring constant gas pressure in spiral tubes.
Non-magnetic shielding tape over cable core.

Roebling Gas-Filled Cable (for voltages up to 46 kv) is *self-supervisory!* Super-dry nitrogen gas, inside this cable at approximately 12 p.s.i. pressure, is the key. When gas pressure drops below 10 p.s.i.—or rises above 16 p.s.i.—an automatic signal message is relayed to the nearest attended station. You know when trouble's afoot the second it starts! Repairs can be made *before* serious damage occurs!

Along with this extra *protection,* this cable has properties that lessen the possibility of outages! The inert dry nitrogen gas provides consistent dielectric properties throughout the length of the cable. It prevents ionization, too, and the other problems often associated with solid-type oil-impregnated cable. What's more, it's as easy to splice as solid-type! And if your system includes grades, it may prove to be the most inexpensive cable you've ever used!

Our new Gas-Filled Cable book tells more about this superbly-made cable. It's free — write for it. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

Cyclone Furnaces Work Well

(Continued from Page 49)

returned the airheater to normal efficiency.

Coal is conveyed by belt to two ring-type granulators, or crushers, each having a 200-tons-an-hour capacity. These crush coal to ¾ in. top size. The coal passes through two hammer mills which prepare it so that 95% passes through a No. 100 screen, the proper size for burning in the cyclone. The coal is elevated by belt to two 1,200-ton bunkers.

Maintenance of coal-handling equipment costs about 3.6¢ per ton prepared. The entire ring grinding assembly is replaced on each crusher after some 450,000 tons have passed through it. After passing 50,000 tons, each hammer mill gets a rebuilt set of hammers, and the mill grate bars are replaced after 100,000 tons.

Hammers and grates are reconditioned by building up worn areas to original dimensions with hard surfacing welding rod. The hammers, each weighing 16½ lb originally, lose about 1 lb while 50,000 tons of coal pass through the mill. When the maintenance period is extended, proper coal fineness is difficult to maintain.

Re-studding of part of the cyclone furnace front walls was the only major repair work on either boiler unit. This required 10,000 steel studs which were installed in the six cyclones. Wear blocks in the cyclone scrolls were replaced once.

There have been three cooling water leaks in the slag tap hole cooling coils, one coil being replaced because of damage from overheating. This occurred when the water supply was interrupted by a defective control valve. Two leaks were repaired by welding the cracked section in the water coil. During the five years, 21 gas leaks developed in the pressure-tight boiler casing, and these were repaired while the boiler remained in service.

Serviceability of boiler No. 1, started December 1953, has been 96.39%, and that of boiler No. 2, started September 1955, 98.33%. Time for yearly inspection is included in the down time. There has not been an emergency shutdown due to a boiler part failure.

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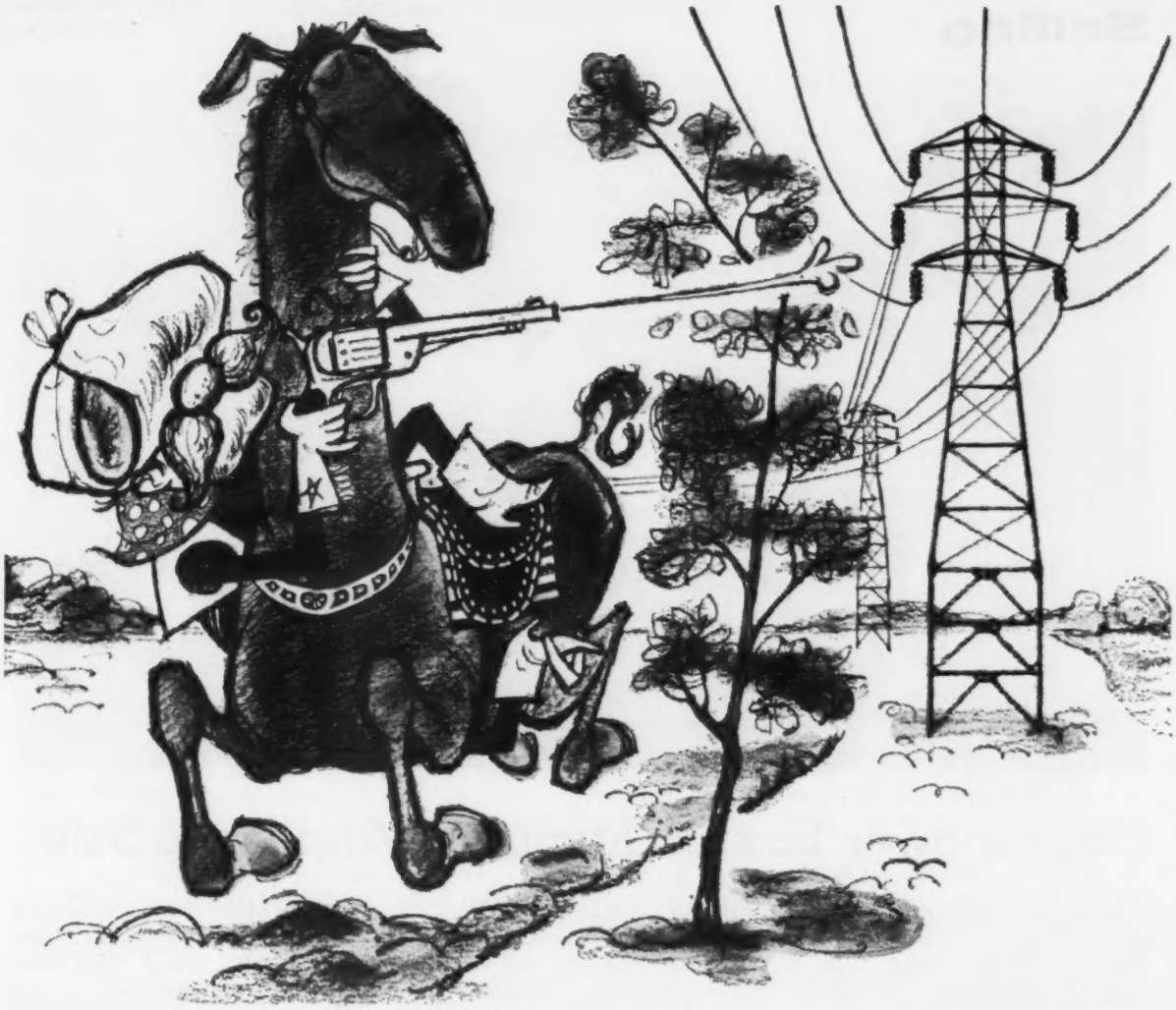

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Diamond Chemicals

Housepower Box To Stimulate Appliance Sales

A big step forward to breaking the residential wiring bottleneck has been initiated by Central Power & Light Co. Its Housepower Incentive program is offering a Housepower Box to stimulate more electric appliance sales. Home owners are encouraged to upgrade their home wiring by eliminating the inadequate service entrance bottleneck.

The Housepower Box panel is a circuit-breaker type service disconnecting device which provides for six main disconnecting breakers in one unit. The breakers are enclosed in an aluminum box 14x17 in. which may be mounted below or on either side of the residential meter. It is manufactured by Walker Electric Co, division of I-T-E Circuit Breaker Co.

The box, less breakers, is available at no charge to employees, builders, contractors, and customers planning to install an electric range, water heater, dryer, central heat pump or 5-kw or more of built-in resistance heating. Before installation of the box, customers must provide a service entrance equal to three No 2 RH copper wires.

The new Housepower Boxes will eliminate frequent changeouts of service entrances as additional appliances are added. Installation of the box will also eliminate the need for a separate main switch.

In areas where cable is not used for service entrances, or where conduit is preferred, appropriate service conductors will be furnished and installed by CP&L in conduit, provided the proper size conduit is furnished by the customer. Minimum conduit sizes acceptable are 1¼ in. for single-phase service and 1½ in. for three-phase.

For all new and old homes which meet the required specifications, CP&L will furnish and install, free of charge, service entrance conductors and a Housepower Box (less breakers.)

For owners of new homes which qualify, CP&L offers special cash incentives ranging from $5 to $50.

The owner of a new Gold Medallion Home will receive $50 in cash in addition to the box and service entrance conductor.

Bronze Medallion Homes will get $35 for homes with an electric water heater installed, and $25 for those without a water heater.

A new home can also qualify by installing two or more circuits for the appliances mentioned above. In addition, the home owner will receive a cash payment of $10 for an electric range installation, $5 for the range outlet only, and $10 for an electric water heater.

About 500 Housepower Boxes have been installed to date.

EEI Issues Weather Book

Edison Electric Institute has issued "Weather Data for Humidity Control Air Conditioning," a 32-page compilation of weather data for various areas of the nation. To be used by utilities in making air conditioning calculations, it is available from EEI, 750 Third Avenue, New York 17, N.Y. Price is $1.00 per copy for Institute members, and $1.50 for non-members.

Cites Threat to Private A-Power (*Continued from page* 41)

$550 for concrete vs $653 for grillages.

A substation's function should determine its design, said H. H. Strozier, Georgia Power Co. It is usually more practical to provide standby capacity in an adjacent station than to complicate the existing station with spare equipment and by-pass features, he said.

Station economy is closely associated with transmission and distribution voltages, Strozier added. Reduced BIL has cut the cost of 115-kv equipment to where it is cheaper to supply 12-kv loads over 3,275 kva by direct transformation from 115 kv than by tapping a substation to the 46-kv system. Line extensions cost less at 46 kv than at 115 kv, but 12-kv loads over 5,600 kva 10 miles from existing lines should be supplied by 115 rather than 46 kv supply for four new distribution substations this year, he said.

Design Standardized

Standardized design has enabled Florida Power Corp to complete 64 major substations and modify 69 others in four years, said B. R. Gaffner. It is built around two sizes of lattice structures for 69-kv buses and two somewhat larger structures for 115 kv, set on standard foundations at standard separations. Space is provided for oil circuit breakers and an additional structure permits automatic sectionalizing. Distribution buses, everywhere 1.25-in. copper tubing, are supported by pipe columns and lattice take-off structures, he said.

Rod gaps give outstanding lightning protection for 83 132 and 110-kv Carolina Power & Light Co. substations, said W. R. Buchanan. Gaps set 20 to 22 in. for 132 kv and 16.5 in. for 110 kv are mounted on the line side insulators of air break switches. Gaps on transformer bushings are set at 26 in. for 132 kv and 20.5 in. for 110 kv. And 71 66-kv substations have gap protection also. Fast relaying clears the gaps after discharge and restores service promptly, he said.

Static elements offer high-reliability quick response and sensitivity for relaying power systems, said C. C. Jones and J. Vandergrift, Alabama Power Co. System growth will bring more use of distance relays and pilot wire or carrier systems to isolate faulted line sections. Back-up protection will become accepted practice for insuring against damage from failure to clear trouble, they said.

The largest savings from an economic dispatch computer frequently develop from its focus on all aspects of economy loading, said W. S. Bloor, Leeds & Northrup Co. But actual installation brings additional savings. The analog type is highly satisfactory, he said, because it is readily actuated by available information to secure outputs which can drive load frequency control systems.

Digital data transmission and logging provide a new method of remote control and telemetering. It provides a typewritten log, displays reading and operations, and improves accuracy at reduced operating cost, said P. W. Schirmer, General Electric Co.

Key to the new system, said Schirmer, is the binary symbol system by which all data are converted to pulses for transmission on any communication channel capable of 15 pulses per sec. Automatic logging can be initiated by the digital clock, working through a programmer to transmit data in predetermined sequence. Simpler systems can telemeter a few quantities in sequence or display specific data through operation of a selector, he said.

Cuts Cable Corrosion

Cathodic protection reduced cable corrosion for Florida Power & Light, said J. B. Prime Jr. Sacrificial ground mats and cathodic protection rectifiers helped reduce the high south Florida corrosion rate.

With experience obtained from network application of cathodic protection, new concepts for underground construction were formulated. They include use of a jacketed neutral on top of all new duct line extensions and design of a grounding system for manholes. A special manhole provides not only for isolated grounding, but for cathodic protection to cables through buried zinc bar.

When an old but operating distribution transformer has been taken out of service, is it economical to retire it, or should it go through normal maintenance and return to service? J. O. Sweeny, General Electric Co, outlined results of a transformer retirement study:

Distribution transformer failure rates of various utilities were studied. It was found, generally, that it is often economical to reinstall transformers up to 40 years old. Sweeny emphasized that the purely economic considerations need to be modified by factors, such as quality of service and maintenance costs.

L. D. Cronin, Ebasco Services, development is sound, future higher distribution voltages should be introduced by conversion of substransmission systems to distribution operation and elimination of one or more transformations in the supply system.

Gives Voltage Steps

The next logical step is to 13.2/23 kv for companies which have 23-kv subtransmission. Above this should be 20/34.5 kv, attractive to companies with 34.5-kv subtransmission. The next level (which may be some time in the future) should be 26.5/46 kv.

Utilities should use American Standards Association specifications more often in ordering line poles, said J. A. Vaughan, Southern Wood Preserving Co. ASA specifications make the best use of woods-run pole timber. Most companies order poles differing from the ASA specifications, and, as the wood preserver finds it more difficult to secure poles to satisfy all specifications, prices go up.

When a pole is for a special use, selection may be made from yard stocks. If more than a few are needed the utility should place a special order, Vaughan explained.

New Helicopter Added

Helicopter fleet of Ontario Hydro will have addition this month of turbine-powered craft with a payload 2½ times models now used by the commission. The diesel-fueled 'copter will save at least $17,000 a year in spraying operations and heavy equipment transport.

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1	2500	Mol.	44,000-2400/4160, 3 Ph.
2	2500	Wagner	45,800/22,900-4160Y, 3 Ph.
3	500	G.E.	44,000-2400/4160
3	200	West.	44,000-480
1	5000	West.	34,500-13750/6875, 3 Ph.
1	3750	G.E.	34,400-13800/7960, 3 Ph.
2	3000	Upgf.	34,750-4160, 3 Ph.
2	1500	G.E.	34,400-2520, 3 Ph.
3	1000	A.C.	34,650/11,500-2300
3	500	Mol.	34,500-2300/4600
4	333	G.E.	34,650-7200/12470Y
1	300	A.C.	34,500-2400/7200/12470Y
3	333	G.E.	26,400-2420/4190Y
2	1500	G.E.	23,000-2400/4800, 3 Ph.
1	7500	A.C.	13,800-2460, 3 Ph.
3	1667	G.E.	13,800-600
3	667	Kuhl.	13,800-480
1	600	Stand.	13,200-2300, 3 Ph.
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The Meetings Calendar

MAY

Industrial Heating Equipment Association—Spring Meeting, The Homestead, Hot Springs, Va., May 17-20.

Northwest Electric Light & Power Association—Business Development Section, Multnomah Hotel, Portland, Ore., May 18-19.

Fifth National Symposium on Instrumental Methods of Analysis—Sponsored by the Instrument Society of America, Hotel Shamrock Hilton, Houston, Tex., May 18-20.

• **Pennsylvania Electric Association** — Street and Highway Lighting Committee, Waynesboro, Pa., May 19; Prime Movers Committee, Hershey Hotel, Hershey, Pa., May 21-22; Stores Committee, Irem Temple Country Club, Dallas, Pa., May 21-22; Accounting Section Conference, Penn Sheraton Hotel, Pittsburgh, Pa., May 25-26; Electrical System and Equipment Committee, Hotel Roosevelt, Pittsburgh, Pa., May 25-26.

• **National Safety Council**—Executive Committee, Public Utility Section, Benjamin Franklin Hotel, Philadelphia, Pa., May 19-20.

• **American Institute of Electrical Engineers**—Middle Eastern District Meeting, Hotel Lord Baltimore, Baltimore, Md., May 19-21; National Telemetering Conference, Brown Palace and Cosmopolitan Hotel, Denver, Colo., May 25-27.

• **Building Research Institute**—Conference on Building Illumination, Statler-Hilton Hotel, Cleveland, Ohio, May 20-21.

• **Pacific Coast Electrical Association**—51st Annual Convention, Fairmont Hotel, San Francisco, Calif., May 20-22.

• **Hydraulic Institute**—Grove Park Inn, Asheville, N. C., May 24-27.

• **National Assn of Electrical Distributors**—51st Annual Convention, Conrad Hilton Hotel, Chicago, Ill., May 24-27.

• **Northwest Public Power Association**—Annual Membership Meeting, Olympic Hotel, Seattle, Wash., May 25.

• **American Society for Quality Control**—Annual Convention, Public Hall, Cleveland, Ohio, May 25-27.

• **National Telemetering Conference**—Cosmopolitan Hotel, Denver, Colo., May 25-27.

• **Design Engineering Conference**—Sponsored by the American Society of Mechanical Engineers, Convention Hall, Philadelphia, Pa., May 25-28.

• **American Public Power Association**—16th Annual Convention, Olympic Hotel, Seattle, Wash., May 26-28.

JUNE

• **Appalachian Underground Corrosion Short Course**—Sponsored by the West Virginia University, Morgantown, West Va., June 2-4.

• **Northwest Electric Light & Power Association**—Accounting and Business Practice Section, Finlen Hotel, Butte, Mont., June 4-6.

• **Wisconsin Utilities Association**—Accounting Section Convention, Lake Lawn Lodge, Delavan, Wis., June 7-9.

• **Southern Research Institute**—Annual Research Conference, Dinkler-Tutwiler Hotel, Birmingham, Ala., June 11-12.

• **Indiana Society of Professional Engineers**—Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind., June 12-13.

• **United States Committee for the International Conference on Information Processing** — Representing the Institute of Radio Engineers, the Association for Computing Machinery and the American Institute of Electrical Engineers, Paris, France, June 13-22.

• **Michigan Electric Association**—Annual Meeting, Mackinac Island, Michigan, June 22-23.

• **Air Pollution Control Association**—Annual Meeting, Hotel Statler, Los Angeles, Calif., June 24-26.

• **Canadian Electrical Association**—Annual Convention, Manoir Richelieu, Murray Bay, Que., June 24-26.

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STRIP back cable insulation...arrows on INSULINK show how far.

INSERT wire ends; **caps grip and hold cable,** both hands are free for crimping.

CRIMP with standard compression tool... guide lines on INSULINK show where.

Pre-insulated

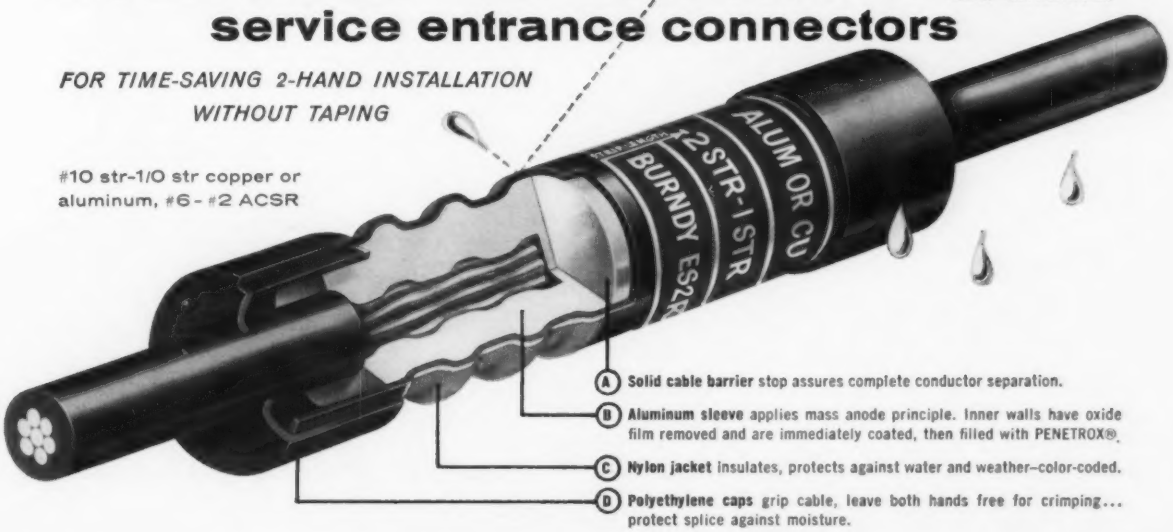
INSULINK®

Patented Other Patents Pending

service entrance connectors

FOR TIME-SAVING 2-HAND INSTALLATION WITHOUT TAPING

#10 str-1/0 str copper or aluminum, #6-#2 ACSR



(A) **Solid cable barrier** stop assures complete conductor separation.

(B) **Aluminum sleeve** applies mass anode principle. Inner walls have oxide film removed and are immediately coated, then filled with PENETROX®.

(C) **Nylon jacket** insulates, protects against water and weather–color-coded.

(D) **Polyethylene caps** grip cable, leave both hands free for crimping... protect splice against moisture.

Connect service entrances with much less effort, in less time, **without taping.** INSULINK pre-insulated compression connectors are installed in three simple steps with the same crimping tools and dies used to install uninsulated connectors...for time-saving economy...for neat, fully protected, electrically stable connections. INSULINK connections are

QUICK: because there's no taping.

EASY: color-coded connector jacket clearly marked to show cable ranges, strip length, where to crimp. Just strip...insert...crimp; caps hold cable ends in place for simple two-hand installation.

SAFE: fully insulated to protect personnel; protected against water and weather; neat, attractive appearance.

Get the full story on **INSULINK** pre-insulated connectors from

BURNDY

57-6

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

1894
First Kuhlman transformer produced within a decade of first transformer introduced in USA.
1915
Established now as a leading transformer manufacturer, Kuhlman made this in World War I days.
1925
This was the characteristic shape of the welded tanks of the Twenties.
1940
Another big step. Rounded tanks and hand grip connectors were universally used by World War II.
1935 Patent applied for in 1929, marketed in 1935, the Kuhlman "Bent Iron" Core revolutionized transformer design.
1959 Serving industry in its 65th year, Kuhlman introduces smaller transformer with lower losses.
KE
TODAY, RESEARCH IS SHAPING THE TRANSFORMER OF THE FUTURE

65 YEARS OF KUHLMAN PIONEERING ACHIEVEMENT . . .

has seen the transformer change as radically as the automobile

Changes in outward appearance have been many and drastic. The compact, sleek and functional shapes are a far cry from the clumsy cans of early day transformers.

More important changes, of course, have taken place inside the tank. New engineering developments, new design concepts, new material utilizations have come thick and fast for improvement in transformer appearance.

Chief among Kuhlman's contributions to the modern transformer is the "Bent Iron" core, first marketed by this company in 1935. This revolutionary concept took advantage of grain-oriented steels to raise overall efficiency, cut losses, improve service life, and open the way to smaller core and coil assemblies.

Kuhlman has made many other contributions to transformer progress. Today, in its 65th year of service, our research and development staffs are working on new and exciting breakthroughs.

Watch for news from Kuhlman!

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ELECTRIC COMPANY

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